AgRISTARS

FC-J1-04175
JSC-17433
VOL. I

A Joint Program for Agriculture and Resources Inventory Surveys Through Aerospace Remote Sensing

Foreign Commodity Production Forecasting

September 28, 1981

PRELIMINARY TECHNICAL RESULTS REVIEW OF FY81 EXPERIMENTS

Volume I

FISCAL YEAR 1981/82 SPRING SMALL GRAINS PILOT EXPERIMENT

(E82-10120) PRELIMINARY TECHNICAL RESULTS REVIEW OF FY81 EXPERIMENTS. VOLUME 1: FISCAL YEAR 1981/82 SPRING SMALL GRAINS PILOT EXPERIMENT (NASA) 259 p HC A12/MF A01 CSCL 02C G3/43

N82-22591

Unclas 00120

Lyndon B. Johnson Space Center
Houston, Texas 77058

This report (Volume I of 2 Volumes) documents the Preliminary Technical Results Review (PTRR) for FY81. The review was held at the Lyndon B. Johnson Space Center on September 28 and 29, 1981. Volume I contains the results presented at the FY81/82 Spring Small Grains Pilot Experiment Review and Volume II contains the results presented at the FY81/82 Corn and Soybeans Experiment Review.

Jon D. Erickson
FCPF Project Manager

FY81 PTRR AGENDA

FY81/82 SPRING SMALL GRAINS PILOT EXPERIMENT

September 28, 1981

PAGE

1.0 OPENING REMARKS

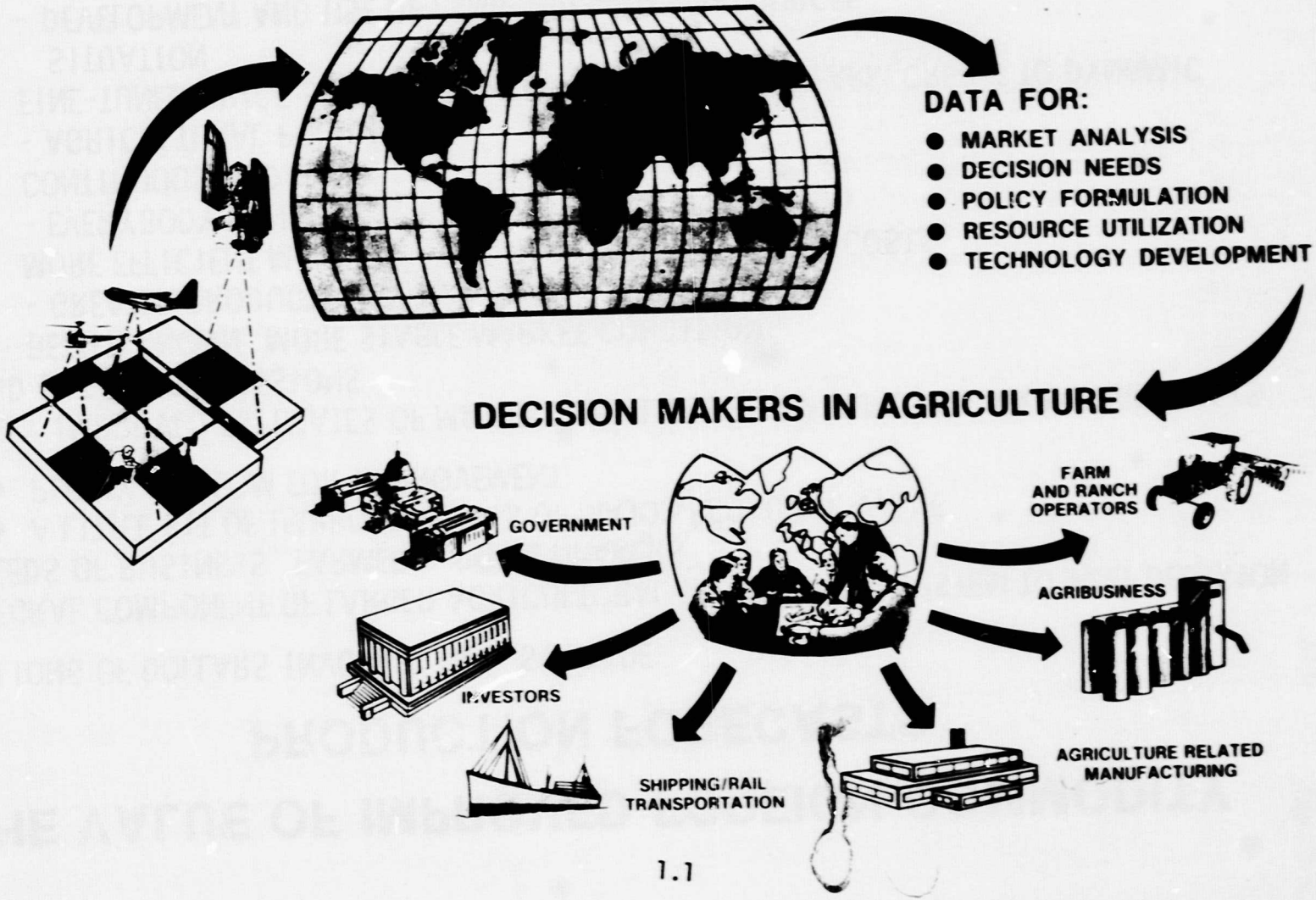
J. D. ERICKSON
9/28/81

NASA National Aeronautics and Space Administration

Lyndon B. Johnson Space Center
Houston, Texas 77058

NASA-S-80-10044

IMPROVE THE QUALITY OF WORLDWIDE AGRICULTURAL INFORMATION THROUGH REMOTE SENSING



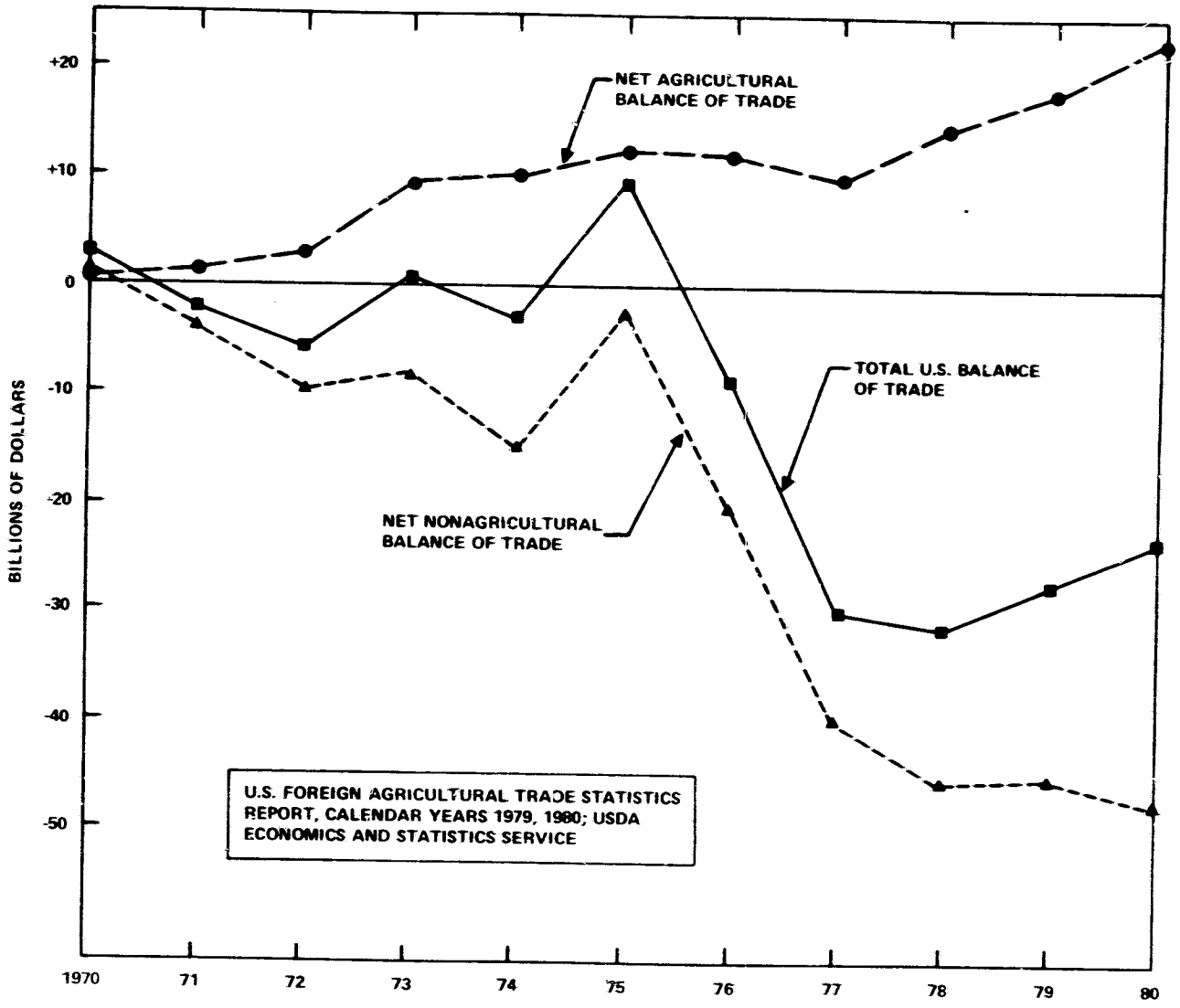
NASA-S-81-11672

THE VALUE OF IMPROVED FOREIGN COMMODITY PRODUCTION FORECASTS

- BILLIONS OF DOLLARS INVOLVED IN U.S. TRADE
- INTEGRAL COMPONENT OF LARGER AGRICULTURAL INFORMATION SYSTEM TO MEET DECISION NEEDS OF BUSINESS, FARMERS, POLICYMAKERS
  - A LITTLE BIT OF IMPROVEMENT IS OF MAJOR ECONOMIC VALUE
  - PLENTY OF ROOM FOR IMPROVEMENT
- TIMELY IMPROVED ESTIMATES OF MAJOR GLOBAL SUPPLIES IMPROVES MARKET ANALYSIS AND BUSINESS DECISIONS
  - BETTER KNOWN, MORE STABLE MARKET CONDITIONS
    - GREATER PRODUCTIVITY IN A STABLE ENVIRONMENT
  - MORE EFFICIENT MARKETS - GREATER PROFIT AT LOWER COSTS
    - EVERYBODY WINS
  - CONTINUOUS UPDATING
    - AGRICULTURAL POLICIES
  - FINE-TUNED PRICE SUPPORTS, ACREAGE PROGRAMS, FARM CREDIT TO DYNAMIC SITUATION
    - DEVELOPMENT AND USE OF LAND AND WATER RESOURCES
    - AGRICULTURAL TECHNOLOGY DEVELOPMENT AND ASSESSMENT

S81 36434

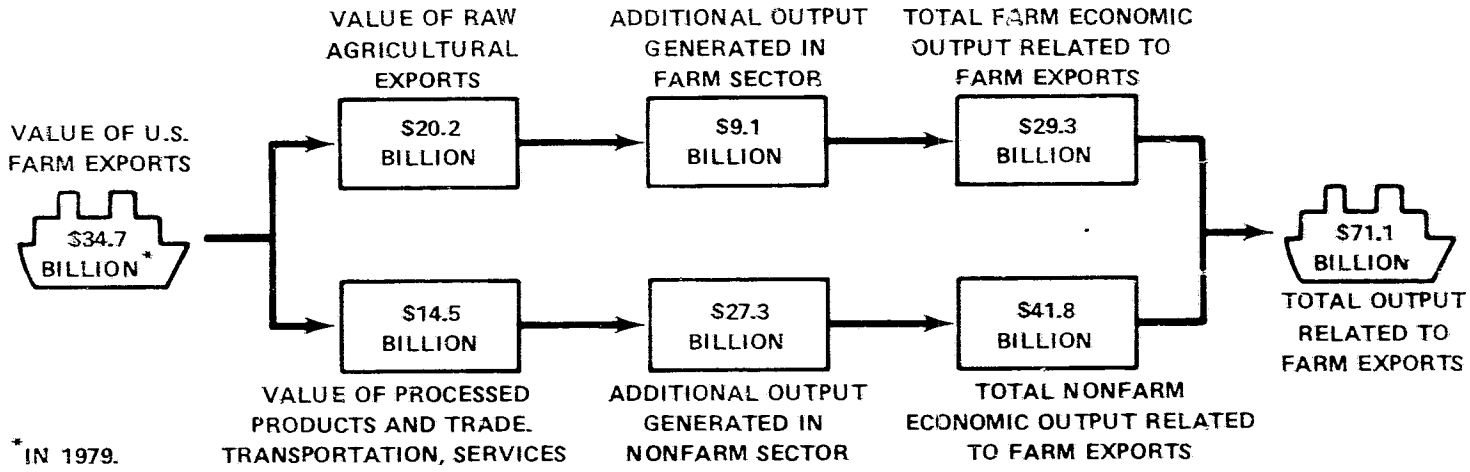
U.S. AGRICULTURE'S CONTRIBUTION TO BALANCE OF TRADE



NASA-S-81-11674

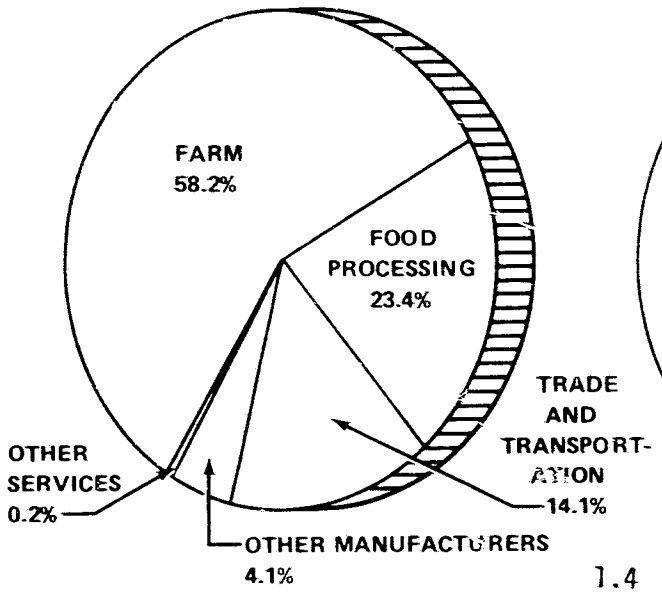
FARM EXPORTS GREEN UP U.S. ECONOMY

FARM EXPORT EMPACTS FLOW THROUGH U.S. ECONOMY

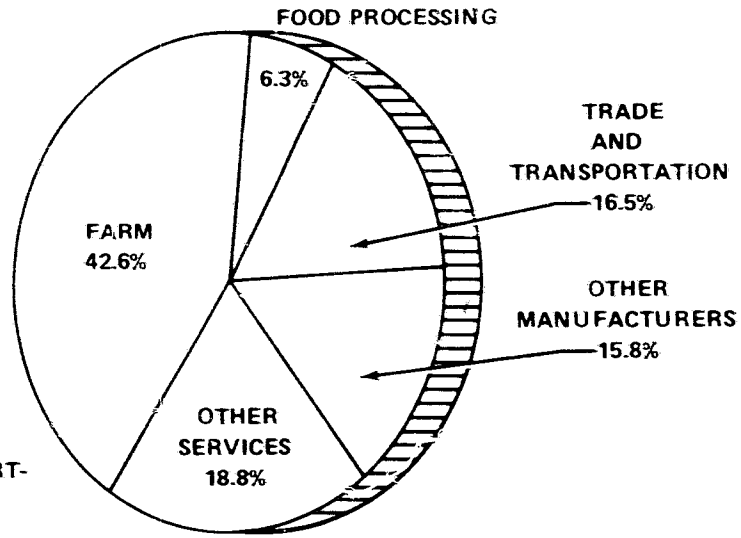


*IN 1979.

WHILE DIRECT EFFECTS OF AGRICULTURAL EXPORTS FAVOR THE FARM SECTOR...

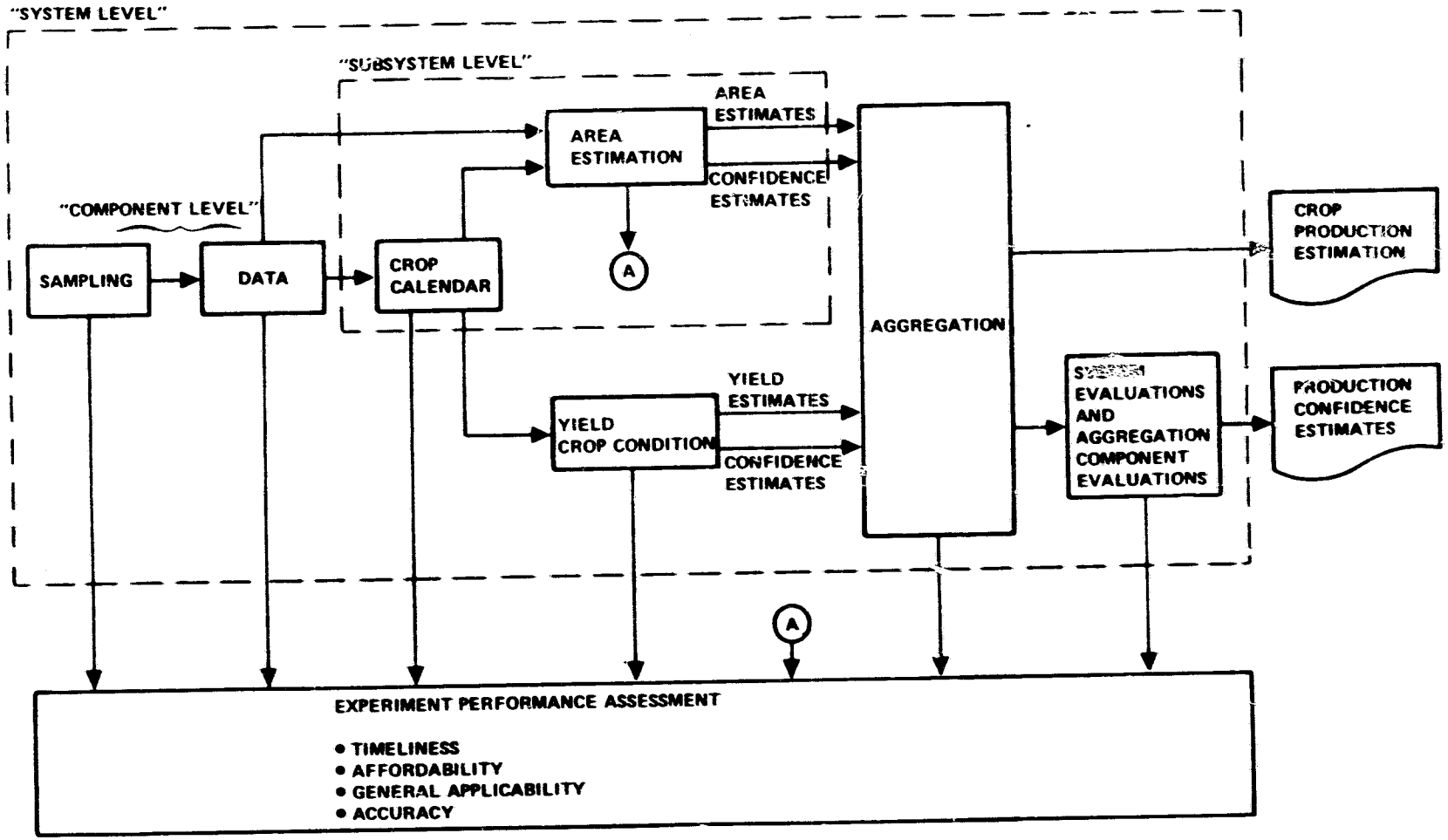


... THE TOTAL INCOME GENERATED IS MORE WIDELY SHARED

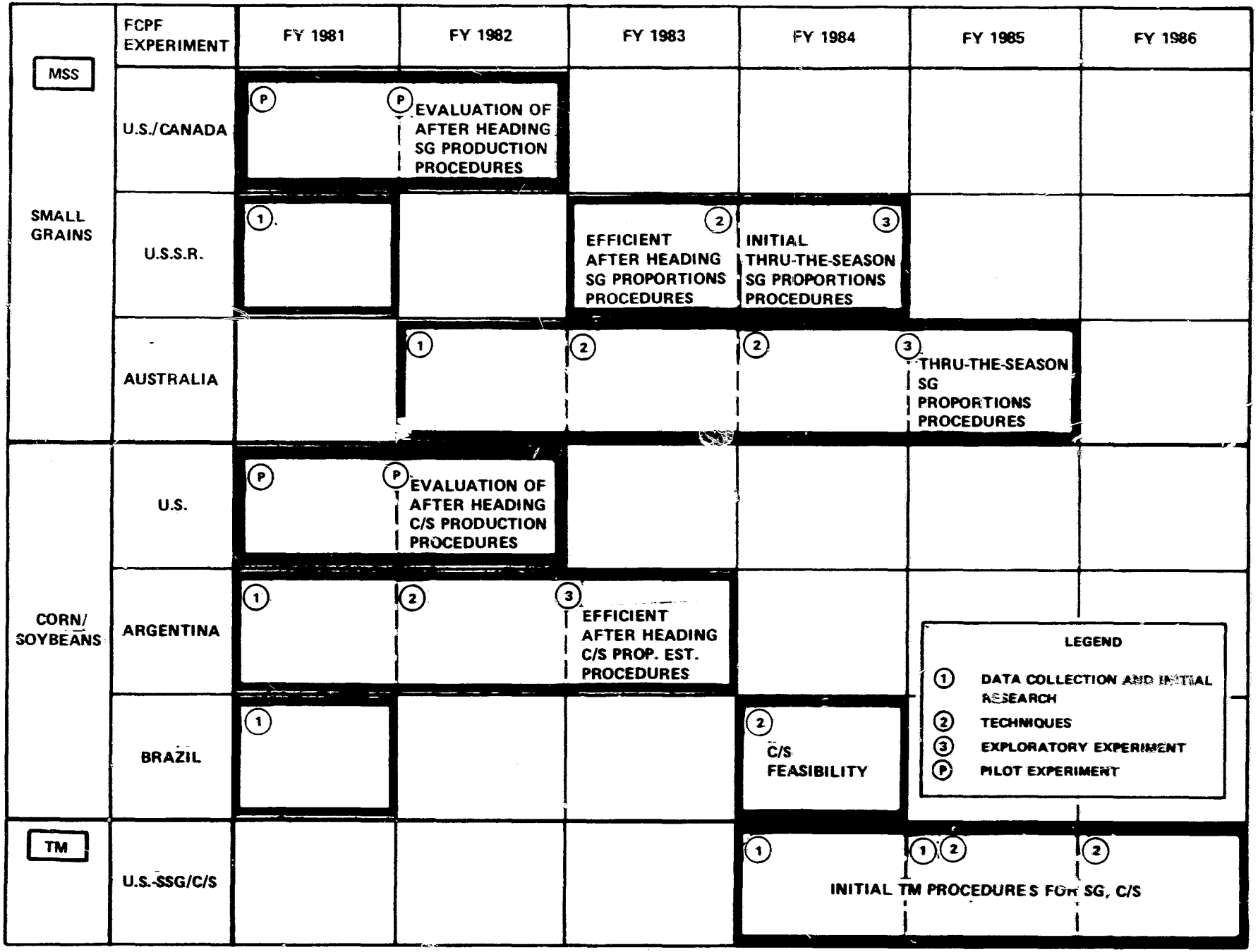


NASA-S-81-11673

FCPF APPLICATIONS
AGRICULTURE INFORMATION SYSTEM CONCEPT



FCPF SCHEDULE



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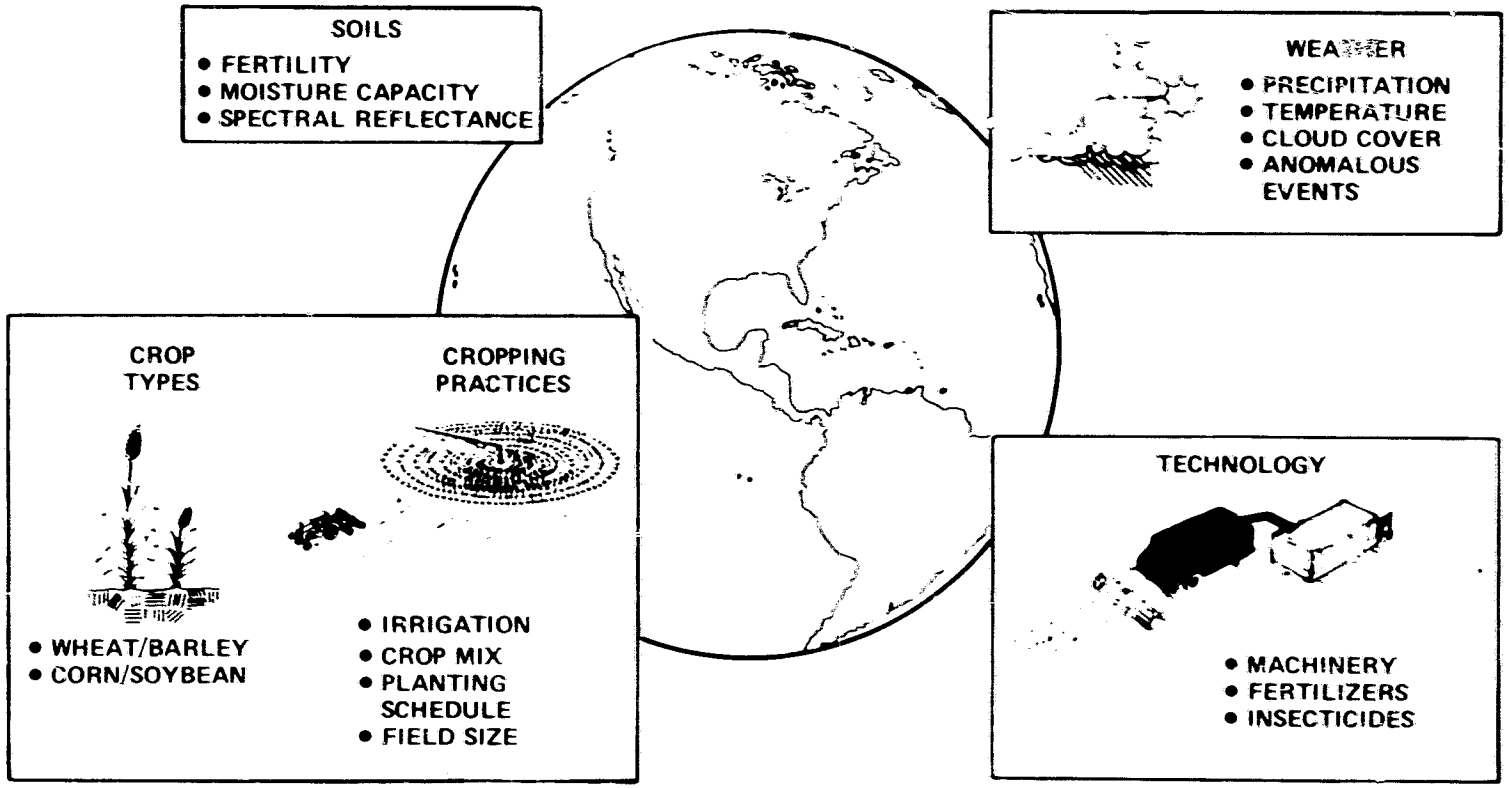
Houston, Texas 77058

NASA S 78 16007 A

GLOBAL FORECASTING MUST DEAL WITH A WIDE RANGE OF HIGHLY-VARIABLE CONDITIONS



NASA-S-81-11671

"TECHNICAL PROGRESS" CRITERIA

TECHNOLOGY PERFORMANCE GOALS

- TIMELINESS
  - ESTIMATES DURING SEASON
  - QUICK TURNAROUND (FROM EVENT TO ESTIMATE)
- AFFORDABILITY
  - EFFICIENCY
  - COST EFFECTIVENESS
- GENERAL APPLICABILITY
  - APPLICABLE IN FOREIGN AREA (USES ONLY GLOBALLY AVAILABLE INPUTS)
  - OBJECTIVITY
  - GOOD PROCESSIBILITY (CAPABLE OF PROCESSING LARGE PERCENTAGE OF ACQUISITIONS
  - FLEXIBLE, IMPROVABLE
  - UNDERSTANDABLE TO USER
- ACCURACY
  - BIAS - PRECISION
  - CONSISTENCE - RELIABILITY - REPEATABILITY (OVER YEARS)
  - RESPONSIVE TO "SIGNIFICANT" FACTORS (PARTICULARLY "DEPARTURES FROM AVERAGE")

NASA-S-81-11678

OUTLOOK

- FULLY EXPECT, BASED ON RESULTS TO DATE, TO HAVE WITHIN PLANNED AGRISTARS TIME FRAME AND RESOURCES
  - TOTALLY AUTOMATED PROCEDURE - FROM DATA BASE TO ESTIMATE - FOR SMALL GRAINS (POST HEADING SSG, NEAR JOINTING WSG) FOR U.S.S.R. AND AUSTRALIA
  - HIGHLY AUTOMATED CORN/SORGHUM AND SOYBEAN PROCEDURE FOR ARGENTINA
  - ALL PROCEDURES WILL BE EFFICIENT AND OBJECTIVE WITH HIGH RELIABILITY
  - CAPABILITY, THRU SIMULATION, TO PREDICT PERFORMANCE FOR A VARIETY OF CROPS/REGIONS/REMOTE SENSING SYSTEMS
- REASONABLE EXPECTATIONS INCLUDE
  - EARLY SEASON SPRING AND SUMMER CROP ESTIMATES
  - PLANTING/EMERGENCE RATE ESTIMATES
  - SYSTEM DIFINITION FOR EQUIVALENT CAPABILITY FOR BRAZIL AND SMALL FIELDS COUNTRIES (INDIA/CHINA)
- HIGH RISK EXPECTATIONS INCLUDE
  - WITHIN SEASON CROP TYPE ESTIMATES FOR WHEAT, BARLEY, CORN, SOYBEANS
  - QUANTIFICATION OF THEMATIC MAPPER BENEFITS
- DATA COSTS HAVE BECOME AND WILL REMAIN THE PACING ITEM IN ESTABLISHING THE SCOPE OF FUTURE EXPERIMENTS AND OPERATIONS

2.0 INTRODUCTION

FCPF SPRING SMALL GRAINS PTRR

OBJECTIVE

- TO PRESENT TECHNICAL PROGRESS MADE DURING FY81 IN FCPF FOR THE ADVANCEMENT OF SPRING SMALL GRAINS AREA ESTIMATION TECHNOLOGY
- EMPHASIS ON RESULTS ACHIEVED SINCE THE LAST AgRISTARS LEVEL 1 SEMI-ANNUAL REVIEW ON APRIL 28, 1981 (REF. DOCUMENT NO. FC-J1-04087)

APPROACH

THIS SERIES OF PRESENTATIONS IS SEPARATED IN THREE MAJOR AREAS:

- INTRODUCTION

  DISCUSSION OF BACKGROUND – STATUS OF TECHNOLOGY 1 OCTOBER 1980, FCPF EXPERIMENTS MECHANISMS, US SSG EXPERIMENT DESIGN OVERVIEW AND PREVIEW OF MAJOR FY81 ACCOMPLISHMENTS

- PRELIMINARY RESULTS

  DETAILS OF RESULTS FROM THE FY81 SSG EXPERIMENT

- SUMMARY

  REVIEW OF MAJOR ACCOMPLISHMENTS, TECHNOLOGY STATUS AND PROGNOSIS FOR FUTURE FCPF SSG EXPERIMENTS

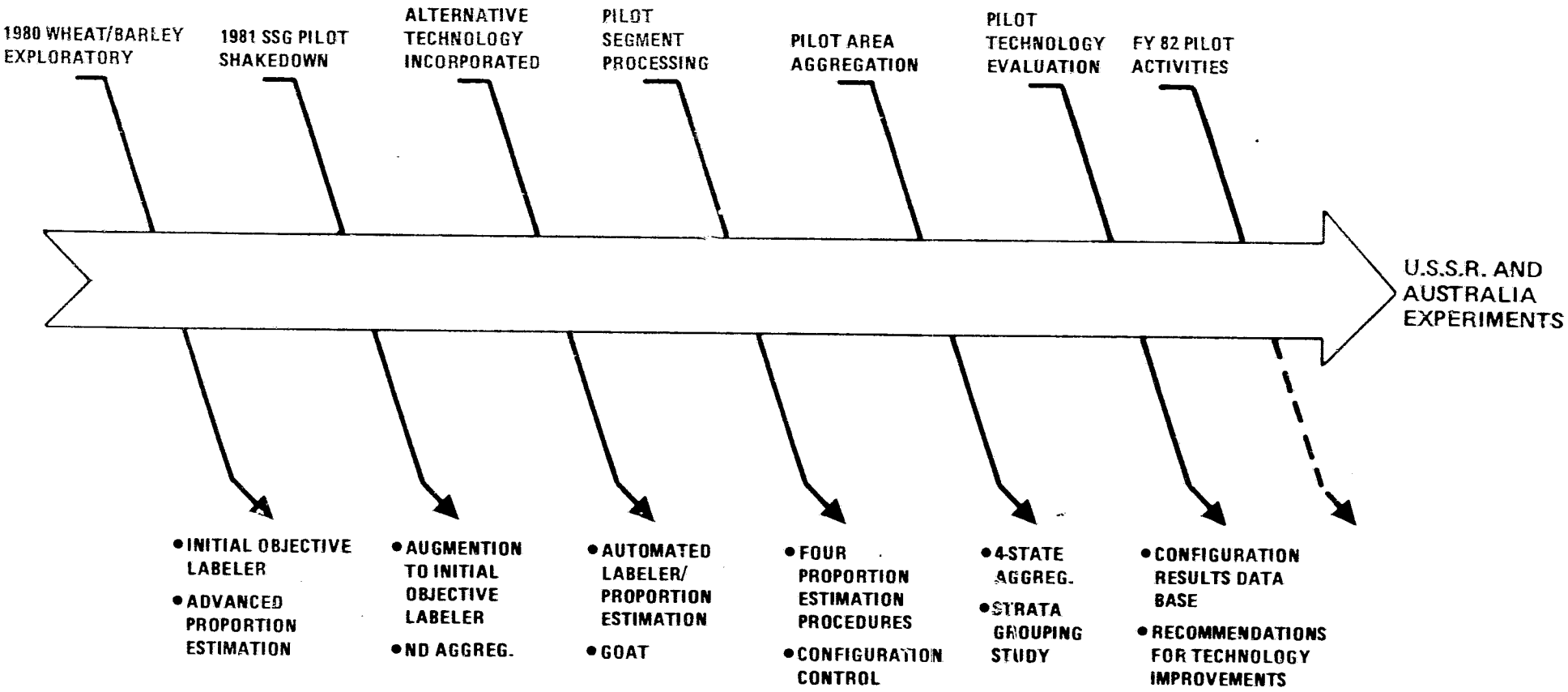
PROGRAMMATIC OBJECTIVES (NEAR-TERM)

- SMALL GRAINS TECHNOLOGY FOR FOREIGN REGIONS
  - -- USSR
  - -- AUSTRALIA
- HIGHLY EFFICIENT PRODUCTION ESTIMATION TECHNOLOGY
- PERFORMANCE ESTIMATION IN FOREIGN REGIOND WITHOUT GROUND OBSERVATIONS
  - -- ERROR MODELING
  - -- SIMULATIONS

EXPERIMENT SPECIFIC OBJECTIVES OF THE FISCAL YEAR (FY) 1981-82 FOREIGN COMMODITY PRODUCTION FORECASTING (FCPF) U.S./CANADA SPRING SMALL GRAINS PILOT EXPERIMENT

- ESTABLISH RESEARCH TECHNOLOGY FOR AT-HARVEST SPRING SMALL GRAINS AREA ESTIMATION.
- TEST AND EVALUATE ALTERNATE AUTOMATED PROPORTION ESTIMATION PROCEDURES FOR AT-HARVEST SPRING SMALL GRAINS OVER MULTIPLE YEARS.
- EVALUATE SENSITIVITY OF AREA ESTIMATION TECHNOLOGIES TO METEOROLOGICAL VARIABLES AND DATA COLLECTION OVER MULTIPLE YEARS TO SUPPORT ERROR MODELING AND ADAPTATION TO FOREIGN ENVIRONMENTS.
- EVALUATE THE SUBCOMPONENTS OF THREE TECHNOLOGIES FOR AT-HARVEST SPRING SMALL GRAINS PROPORTION ESTIMATION.
- EVALUATE THE AREA COMPONENTS OF THE PRODUCTION ESTIMATION SYSTEM.
  - CROP CALENDAR
  - AREA ESTIMATION
  - AGGREGATION TO AREA
- SUPPORT DEVELOPMENT OF METHODOLOGY FOR ESTIMATING THE PERFORMANCE OF THE TECHNOLOGY IN FOREIGN AREAS.
- IDENTIFY SUBSEQUENT REFINEMENTS/IMPROVEMENTS IN THE TECHNOLOGY FOR APPLICATION IN FOREIGN AREAS, PARTICULARLY THE UNION OF SOVIET SOCIALIST REPUBLICS (USSR) AND AUSTRALIA.

MAJOR EVENTS



PRODUCTS

9/28/81

FCPF SPRING SMALL GRAINS TECHNOLOGY STATUS AT FY80 PTRR

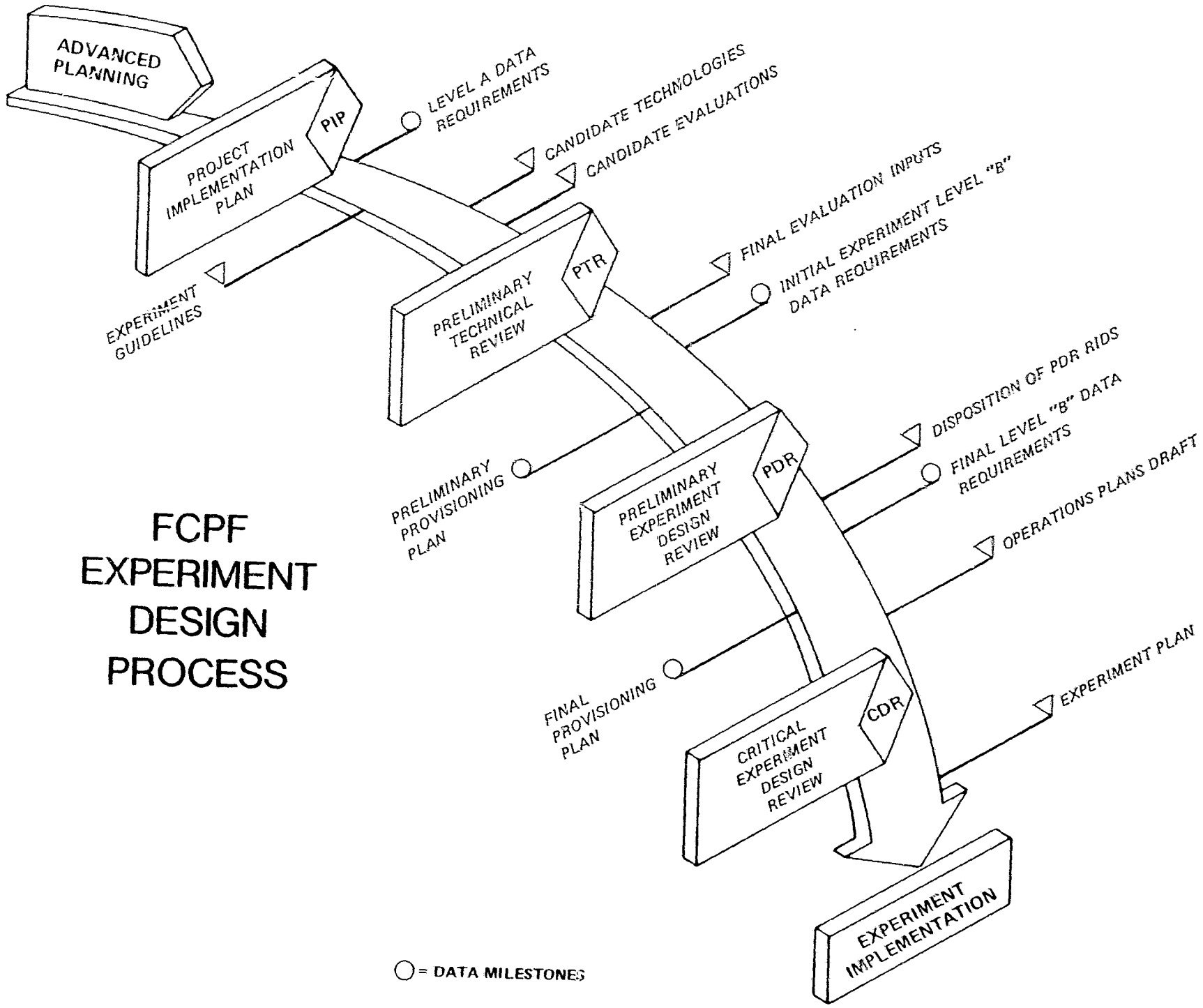
- "... IT IS CONCLUDED THAT:
  - THE PILOT EXPERIMENT SHOULD FOCUS ON SENSITIVITY ANALYSIS OF SPRING SMALL GRAINS AREA ESTIMATION PROCEDURES.
  - THE RESULTS OF THE EXPLORATORY INDICATE A STRONG POTENTIAL FOR ESTABLISHING THE BASIS FOR A HIGHLY EFFICIENT TECHNOLOGY.
  - MORE KNOWLEDGE IS REQUIRED BEFORE A WHEAT/BARLEY PILOT EXPERIMENT CAN BE CONDUCTED."

(REF: 1980 U.S./CANADA WHEAT AND BARLEY EXPLORATORY EXPERIMENT SUMMARY REPORT, FC-L1-04127)

FY81 SPRING SMALL GRAINS EXPERIMENT BACKGROUND

EVENT	PLANNED	ACTUAL
SHAKEDOWN	• PROCESS USING BASELINE LABELING LOGIC	• SAME
PROPORTION ESTIMATION	• PROCESS USING USNGP'S AND SASKATCHEWAN USING BASELINE PROCEDURE (SSG2)	• PROCESS USNGP'S AND SASKATCHEWAN USING THREE NEW AUTOMATED TECHNOLOGIES • SSG2 PROCESSING REDUCED TO SUPPORT TECHNICAL DEVELOPMENT; MANUAL ACQUISITION SUBCOMPONENT ADDED
AREA ESTIMATION	• STRATA GROUPING APPROACH COMPARISON STUDY • AGGREGATION LOGIC STUDY WITH 1978 NORTH DAKOTA AREA AGGREGATION IMPROVEMENTS (GOAT) AND SSG2 PROPORTION ESTIMATION TECHNIQUES	• SAME • AGGREGATION LOGIC STUDY WITH 1978 NORTH DAKOTA AREA AGGREGATION IMPROVEMENTS (GOAT) USING SSG3B, SSG3C AND SSG4 PROPORTION ESTIMATION PROCEDURES • AGGREGATION LOGIC STUDY IN USNGP'S (4-STATE AREA) ON FOUR YEARS OF GROUND TRUTH SEGMENTS WITH SSG3B, SSG3C AND SSG4 PROPORTION ESTIMATION PROCEDURES

FCPF EXPERIMENT DESIGN PROCESS



REPORTING ORG./ACTIVITY:

DATE

PAGE

ACTIVITY

O N D J F M A M J J A S O N D J F M A M J J A S

REFERENCE MILESTONES

FY 1981 FUNDING AUTHORIZATION

PIP APPROVAL

PIP APPROVAL

FY 1982 FUNDING AUTHORIZATION

PIP APPROVAL

• U.S./CANADA SPRING SMALL GRAINS PILOT

SSG3B, 3C & 4 PRELIM. EVAL. RESULTS

1-STATE SSG3B, 3C & 4 AGGRE. COMPLETE

SSG3B, 3C & 4 SEG. PROCESSING COMPLETE

INITIATE SSG3B, 3C & 4 SEG. PROCESSING

EXP. DESIGN

SEG. ALLOC.

FINAL REQS.

INITIATE SSG2 SEG. PROCESSING

PTRR

INITIATE SSG 3B SEG. PROCESSING

SSG3B SEG. PROCESSING COMP.

SSG3B, 3C & 4 FINAL EVAL. COMPLETE

SSG2 SEG. PROCESSING COMPLETE

SSG2 AGGRE. COMPLETE

EVAL. COMP. PTRR

ORIGINAL PAGE IS OF POOR QUALITY

OUTPUT PRODUCT MILESTONES

SSG3B, 3C & 4 ERROR MODEL DEV. INPUT

• SSG PTRR

SSG 2 & 3B ERROR MODEL DEV. INPUT

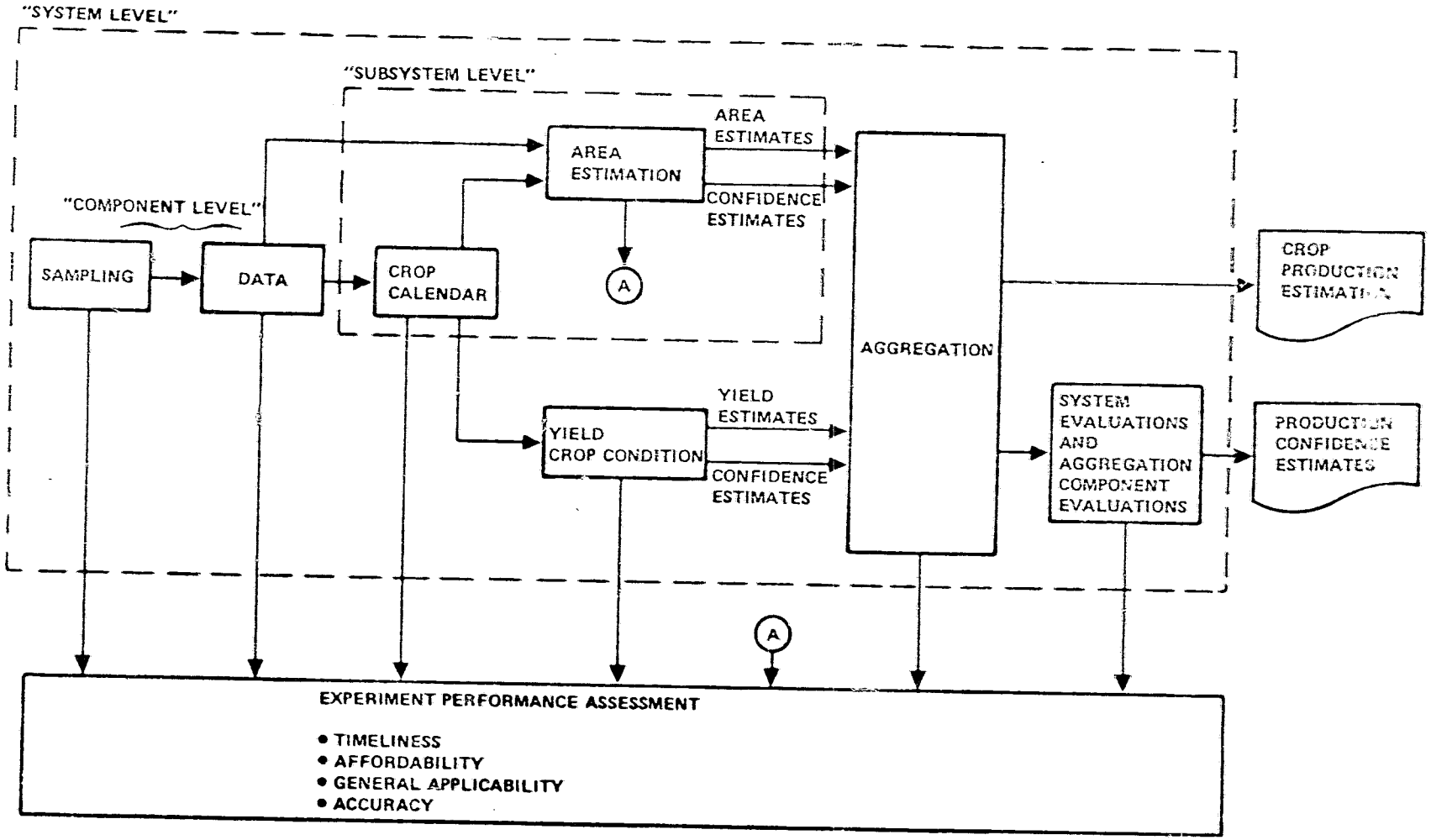
• SSG PTRR

JSC Form 543 (OT) Jan. '80

RA84-JSC

NASA S-81-11673

FCPF APPLICATIONS
AGRICULTURE INFORMATION SYSTEM CONCEPT



"TECHNICAL PROGRESS" CRITERIA

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  - QUICK TURNAROUND (FROM EVENT TO ESTIMATE)
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  - GOOD PROCESSABILITY (CAPABLE OF PROCESSING LARGE PERCENTAGE OF SEGMENT ACQUISITIONS)
  - FLEXIBLE, IMPROVABLE
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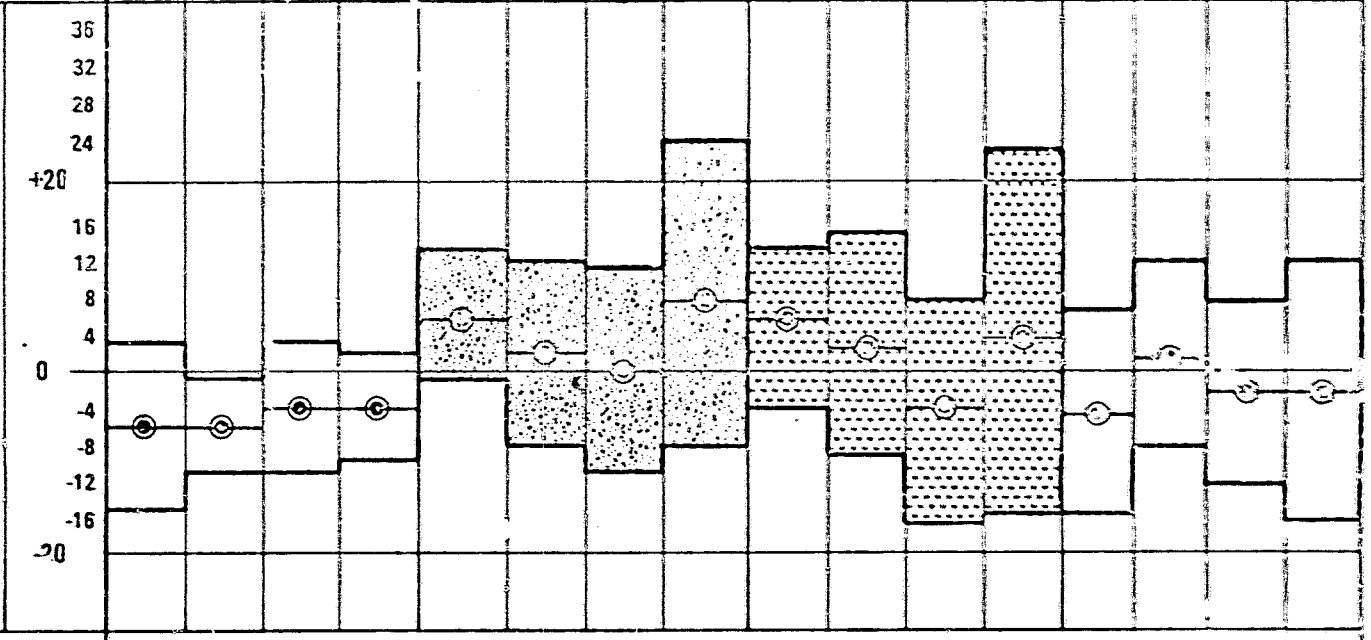
- ACCURACY
  - BIAS — PRECISION
  - CONSISTENCE – RELIABILITY – REPEATABILITY (OVER YEARS)
  - RESPONSIVE TO "SIGNIFICANT" FACTORS (PARTICULARLY "DEPARTURES FROM AVERAGE")

LEGEND
Red-Specifically addressed
Blue-Partially addressed
Yellow-Indirectly addressed

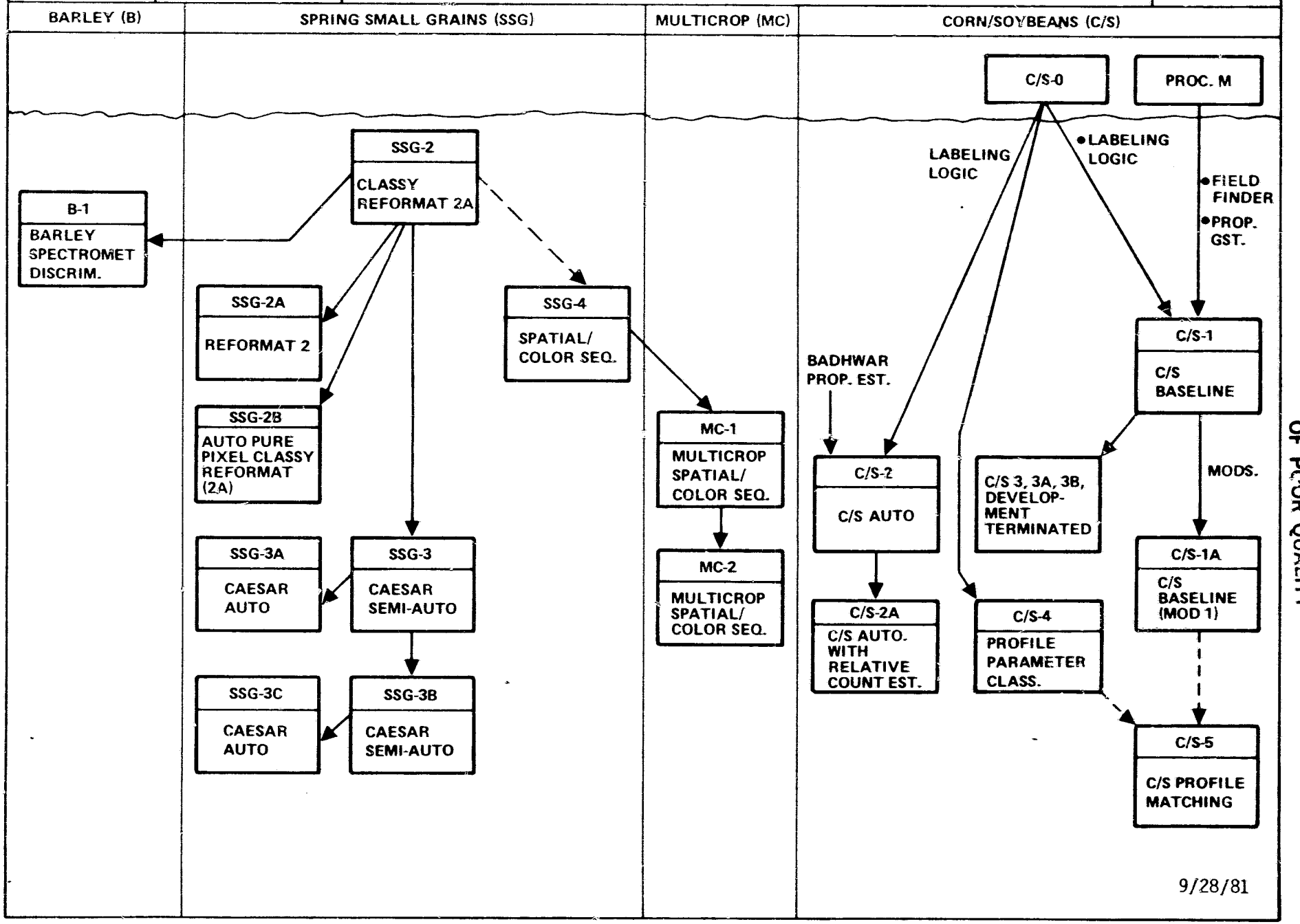
FY81 FCPF PERFORMANCE CRITERIA

CRITERIA	SUBCRITERIA – EXPERIMENT EMPHASIS COMMENTS
TIMELINESS	• TURNAROUND IN LSAT-LIKE ENVIRONMENT, MECHANISM FOR PROVIDING COMPONENT PLANNING ESTIMATES
	• EARLY SEASON – NOT ADDRESSED
AFFORDABILITY	• EFFICIENCY OF PROCEDURES; MAN/MACHINE OPTIMIZATION
	• COST EFFECTIVENESS – INDIRECT MEASUREMENTS
GENERAL APPLICABILITY	• OBJECTIVITY – AUTOMATED TECHNOLOGY (NO Q.A.)
	• PROCESSABILITY – EVALUATED ALL PROCEDURES FOR THIS ASPECT
	• FLEXIBLE, IMPROVABLE – BY DESIGN FOR FOREIGN ADAPTATION
	• UNDERSTANDABLE – EXPERT NOT REQUIRED
ACCURACY	• BIAS, PRECISION – CALCULATED FOR ALL PROCEDURES
	• CONSISTENCY – FOUR-YEAR TEST
	• RESPONSIVENESS – FEATURE OF DATA SET, BUT NOT EMPHASIZED SPECIFICALLY BY DESIGN

FOR IMPROVEMENTS IN SPRING SMALL GRAINS AREA ESTIMATION PERFORMANCE

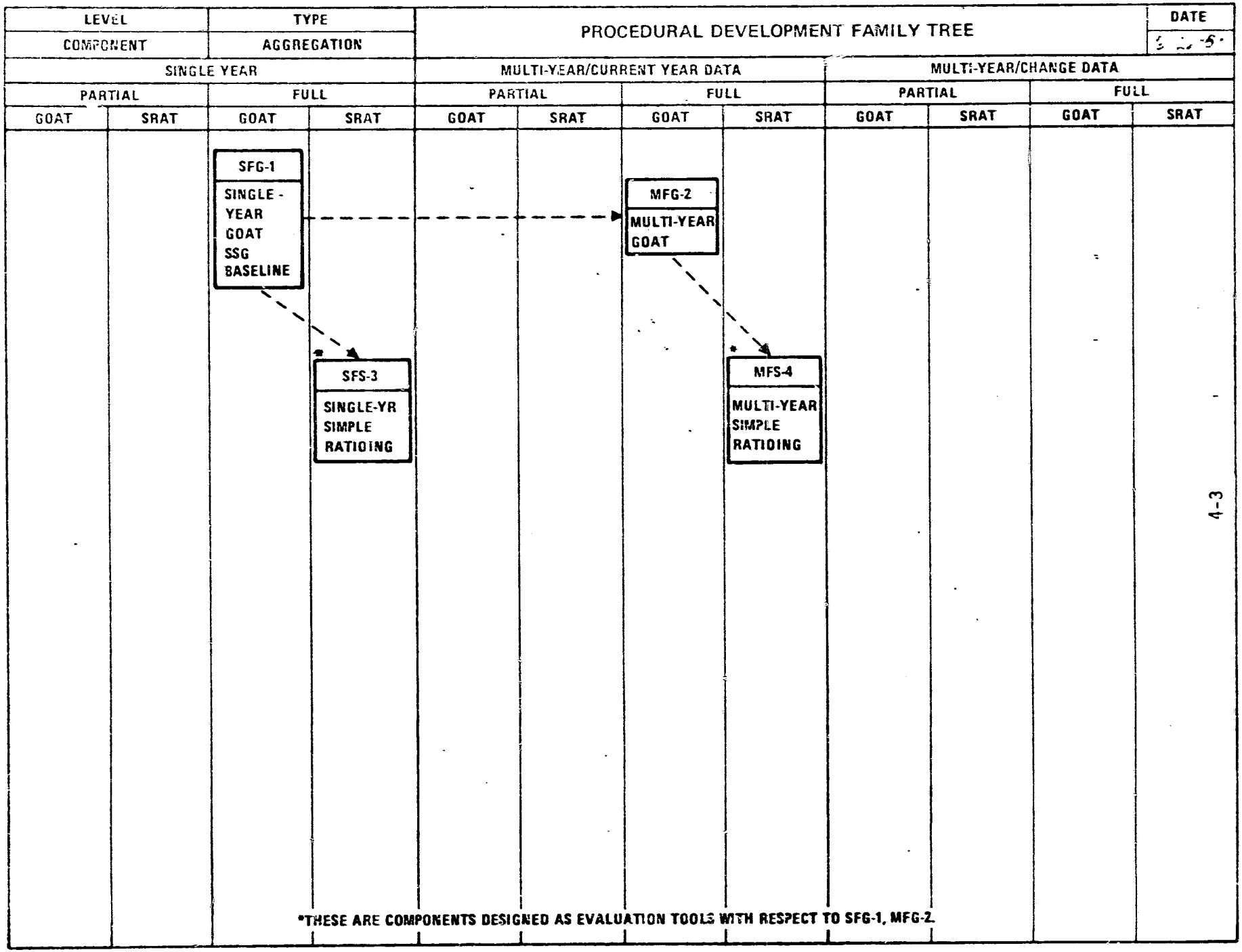
	TECHNICAL PROGRESS CRITERIA			PRE-AgRISTARS PROCEDURE				AGRISTARS											
								SSG3F				SSG3C				SSG4			
				76	77	78	79	76	77	78	79	76	77	78	79	76	77	78	79
(A)	PER SEGMENT ACCURACY ● MEAN ERROR (WITH RESPECT TO GROUND OBSERVATIONS) ± STD. DEVIATION																		
(B)	TIMELINESS	DURING SEASON ESTIMATION		AFTER HEADING															
		TURNAROUND	ACQ–JSC	13 CALENDAR DAYS															
			JSC PROCESSING	12 DAYS				8 DAYS				6 DAYS				6 DAYS			
(C)	APPLICABILITY	PROCESSIBILITY		66%				54%				47%				63%			
(D)	AFFORDABILITY – PER SEGMENT EFFICIENCY	COMPUTER TIME (CPU) *AS-3000 EQUIVALENT		60 MIN.*				21 MIN.				20 MIN.				13 MIN.			
		ANALYST TIME		4 HOURS				2 HOURS				1 HOUR				30 MIN.			

LEVEL	TYPE	PROCEDURAL DEVELOPMENT FAMILY TREE	DATE
SUBSYSTEM	AREA ESTIMATION		9/22/81



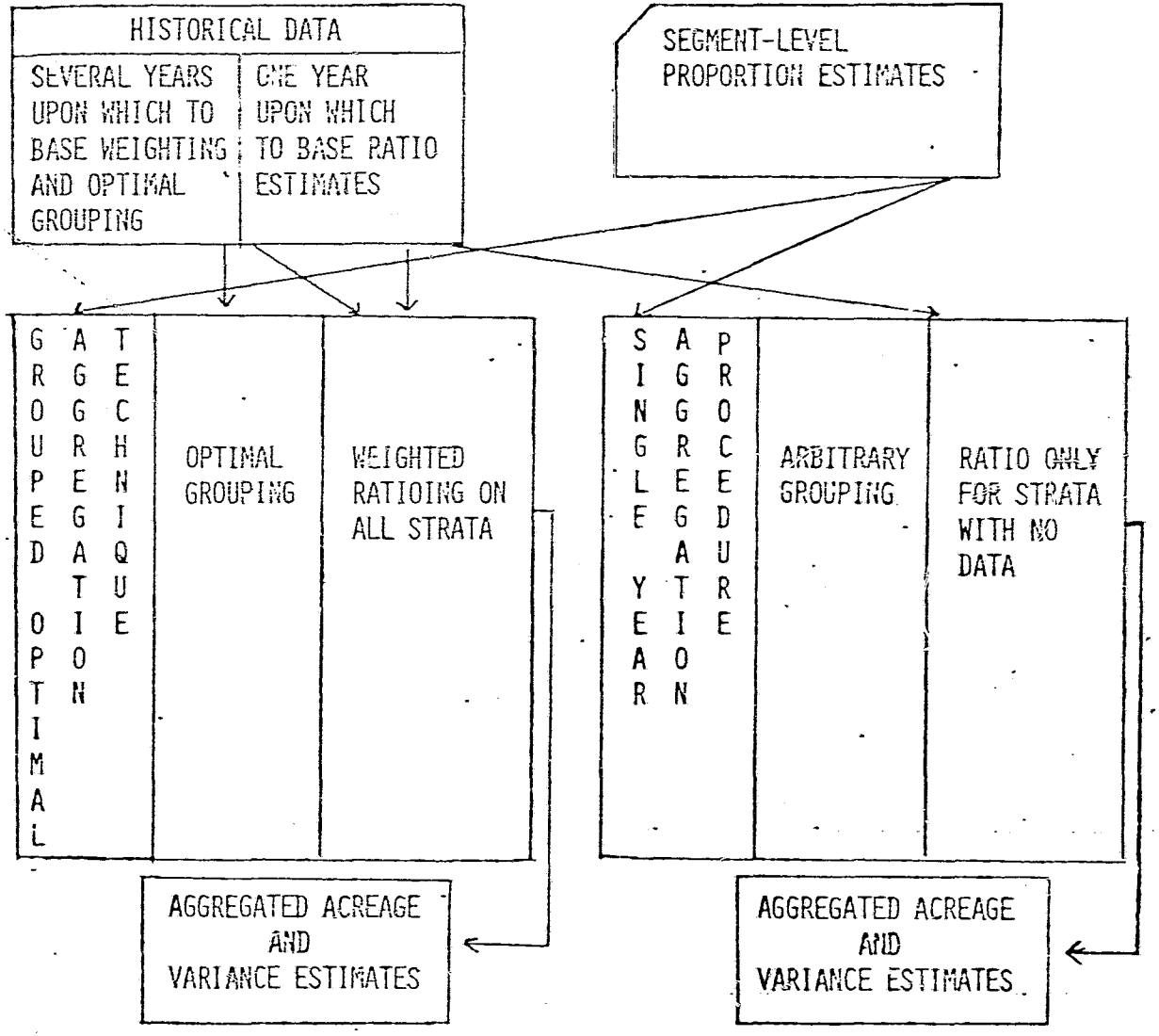
MAJOR DIFFERENCES AMONG THE THREE PROPORTION ESTIMATION PROCEDURES

FUNCTION	SSG3B	SSG3C	SSG4
• SAMPLING			
- Target	- Pixels	- Pixels	- Quasi-Fields
- Method of Selection	- Systematic Sample	- Systematic Sample	- All Quasi-Fields
• LABELER			
- Acquisition Selection	- Analyst Verification	- Automated (Biowindow Midpoint Model)	- Automated (Biowindow Duration Model)
- Decision Logic	- Hierarchical	- Hierarchical	- Table Look-Up (Binary)
+ Vegetative Index Number	+ Kauth-Thomas	+ Kauth-Thomas	+ Normalized Channel Rankings
• PROPORTION ESTIMATION			
- Sample Size	- 836 Pixels	- 836 Pixels	- All Quasi-Fields
- Method of Estimation	- Relative Count	- Relative Count	- Enumeration with Adjustment

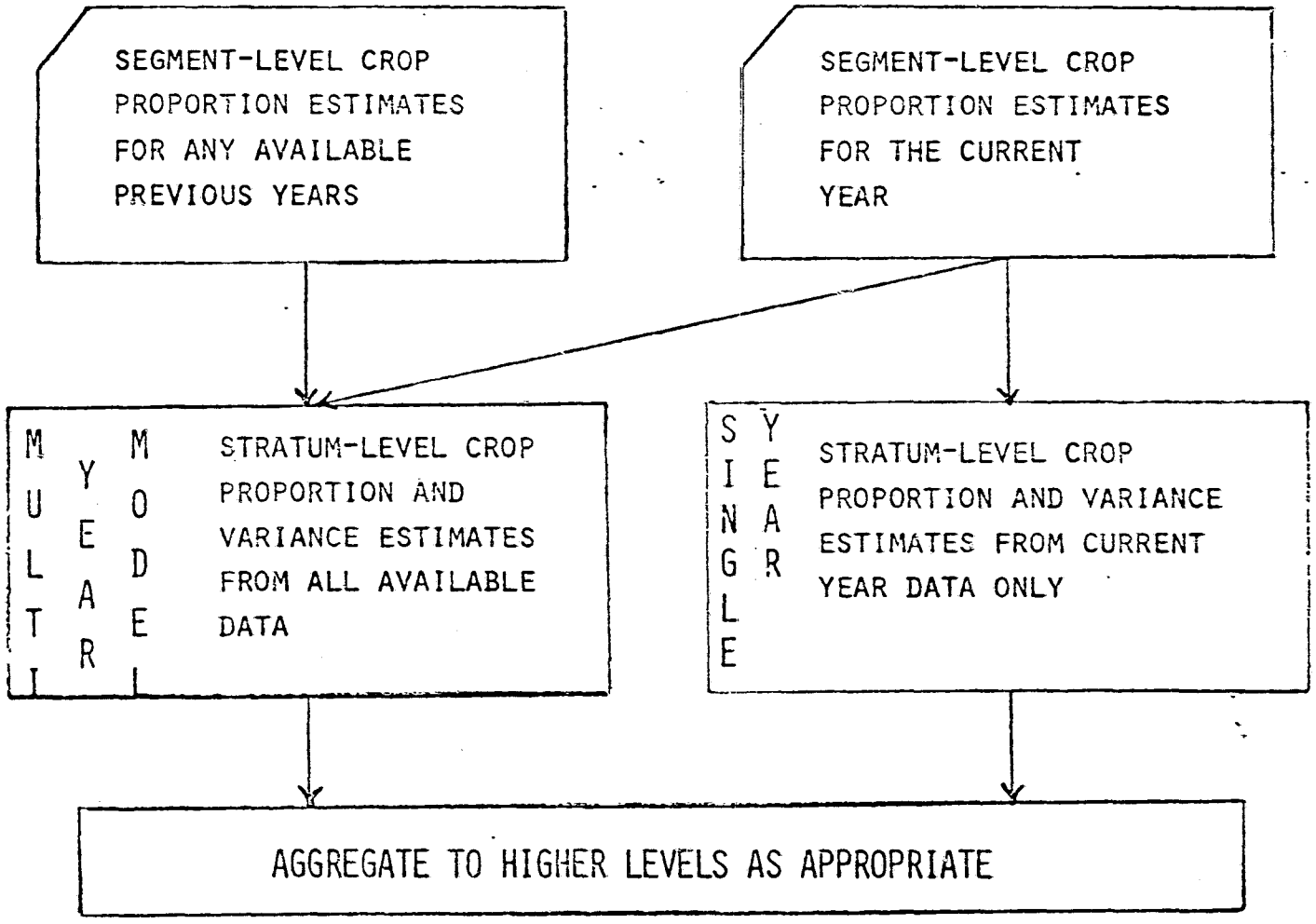


4-3

GOAT VS. SINGLE-YEAR AGGREGATION



THE MULTIYEAR (MY) MODEL VS. SINGLE YEAR



LIST OF FY81/82 EVALUATIONS

EVALUATION	STATUS
PROPORTION ESTIMATION	
• SSG3B PERFORMANCE	
• SSG3C PERFORMANCE	
• SSG4 PERFORMANCE	
* ERROR CHARACTERIZATION	BONUS
• SENSITIVITY STUDIES	
+ CROP STAGE VARIABILITY WITHIN SEGMENTS	
+ CROP STAGE VARIABILITY BETWEEN SEGMENTS	
+ MOISTURE STRESS	
+ RATE OF PROCESSABILITY BY SSG3B, SSG3C, SSG4	
+ ACQUISITION HISTORY STUDY	
+ DUAL SATELLITE	FY82
CROP CALENDAR	
• AUTOMATIC ACQUISITION SELECTION	FY82
• CROP GROWTH STAGE	FY82
• BIOWINDOW MODEL	FY82
AGGREGATION	
• GOAT	
• NORTH DAKOTA AGGREGATION LOGIC STUDY	
• GROUPING APPROACH COMPARISON STUDY	
• FOUR-STATE AGGREGATION LOGIC STUDY	FY82

ACCOMPLISHMENTS

U.S./CANADA SPRING SMALL GRAINS PILOT EXPERIMENT

- COMPLETION OF FY1981 TASKS
  - -- REQUIREMENTS DEFINITION
  - -- EXPERIMENT DESIGN
  - -- PROCEDURES IMPLEMENTATION
  - -- DATA SYSTEMS IMPLEMENTATION
  - -- SOFTWARE/PROCEDURES CONFIGURATION
  - -- SEGMENT ANALYSIS/PROCESSING
  - -- AREA AGGREGATION
  - -- CONFIGURED RESULTS DATA BASES
  - -- PERFORMANCE EVALUATIONS
    - + PROPORTION ESTIMATION
    - + AGGREGATION

3.0 EXPERIMENT DESCRIPTIONS

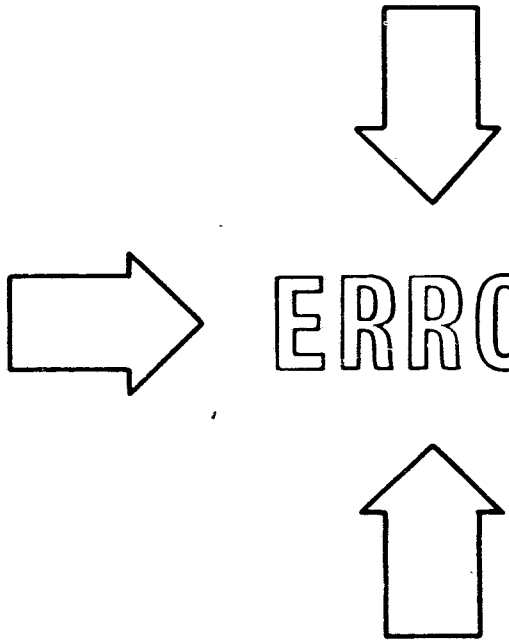
TECHNICAL APPROACH

D. T. REGISTER
9/28/81

SEGMENT-LEVEL AREA ESTIMATION

PROCEDURE DEFICIENCIES:

- LABELING
- TARGET SAMPLING
- ESTIMATION
- BIOWINDOW DESIGNATION
- REGISTRATION



METEOROLOGY:

- RAINFALL AND TEMPERATURE PATTERNS
- LOCATION OF METEOROLOGICAL STATIONS

LANDSAT DATA COLLECTION:

- AMOUNT
- TIMING
- RESOLUTION
- QUALITY

AGRONOMY:

- CROP MIXTURE
- FIELD SIZE
- IRRIGATION
- FARMING PRACTICES

9/28/81

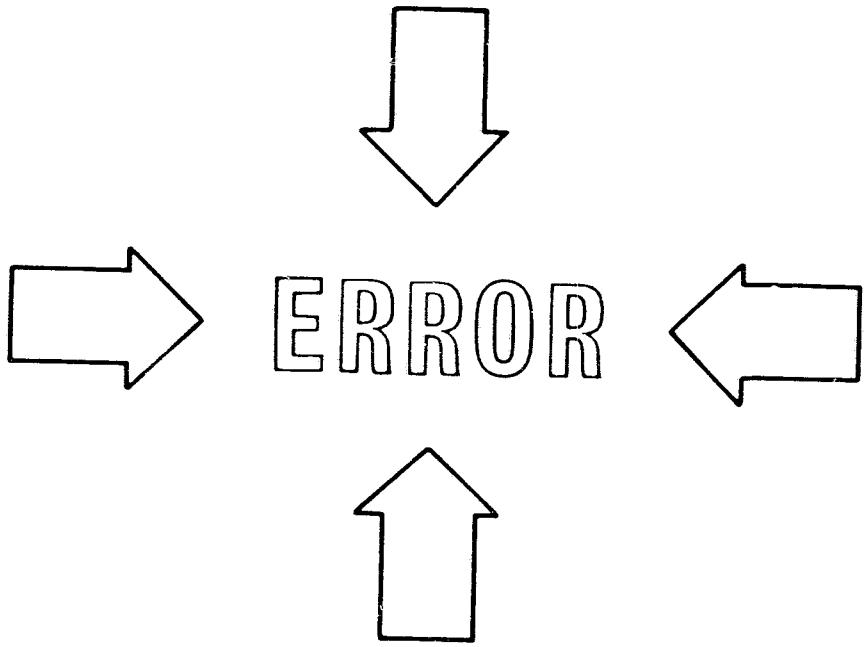
LARGE AREA ESTIMATION

PROCEDURE DEFICIENCIES

- INADEQUATE USE OF HISTORICAL GOVERNMENT STATISTICS
- INADEQUATE ALLOWANCE FOR MISSING DATA
- INADEQUATE USE OF PREVIOUS YEARS PROPORTION ESTIMATES

SAMPLE DEFIENCIES:

- SAMPLING FRAME
- STRATA DELINEATION
- ALLOCATION METHOD
- SAMPLE SIZE
- CHANCE



SEGMENT-LEVEL ESTIMATES:

- PROPORTION ESTIMATION ERROR
- MISSING PROPORTION ESTIMATES
- CROP GROUP PROPORTION ESTIMATES

HISTORICAL GOVERNMENT STATISTICS:

- SPARSE
- INACCURATE

9/28/81

AREA ESTIMATION EVALUATIONS

1981:

EVALUATION	PURPOSE
ESTIMATE LABELING AND PROPORTION ESTIMATION ACCURACY	VALIDATION OF ACCURACY AS COMPARED TO HISTORICAL PERFORMANCE
RATE OF PROCESSABILITY	VALIDATE THE PROCEDURES ABILITY TO PROCESS A LARGE PERCENTAGE OF SEGMENTS
ACQUISITION HISTORY	UNDERSTAND ACQUISITION HISTORY EFFECT ON PROPORTION ESTIMATION ERROR
* ERROR CHARACTERIZATION	DETERMINE THE MAJOR CAUSES OF PROPORTION ESTIMATION ERROR
* BONUS	

AREA ESTIMATION EVALUATIONS (CONTINUED)

1981:

EVALUATION	PURPOSE
SENSITIVITY OF LABELING ACCURACY AND PROPORTION ESTIMATES TO CONDITIIONS OF -	GAIN UNDERSTANDING OF THE RELATIONSHIP BETWEEN METEOROLOGICAL CONDITIONS DURING THE GROWING SEASON AND AREA ESTIMATION PERFORMANCE BY RELATING LABELING/PROPORTION ESTIMATION ERROR TO:
1. CROP STAGE VARIABILITY WITHIN THE CROP GROWING SEASON	PLANTING DATE RANGE
2. CROP STAGE VARIATION BETWEEN CROP GROWING SEASONS	PREDICTED DEVIATIONS FROM NORMAL TIMES FOR HEADING
3. MOISTURE STRESS	A MODEL PREDICTED MEASURE OF CROP MOISTURE

9/28/81

AREA ESTIMATION EVALUATIONS (CONCLUDED)

1982:

EVALUATION	PURPOSE
DUAL SATELLITES	DEMONSTRATE THE BENEFIT OF HAVING MORE THAN ONE SATELLITE IN TERMS OF THE RATE OF PROCESSABILITY
CROP MIXTURE	QUANTIFY THE CONFUSION OF SPRING SMALL GRAINS WITH OTHER GROUND-TRUTH CROPS TO UNDERSTAND LABELING ACCURACY RELATION TO CROP MIXTURES

9/28/81

CROP CALENDAR

1982:

EVALUATION	PURPOSE
PLANTING DATE MODELS FOR SPRING WHEAT AND BARLEY	ASSESS THE FEYERHERM AND HODGES/ ARTLEY MODELS ABILITY TO PREDICT PLANTING DATES ON A METEOROLOGICALLY DIFFERENT YEAR
SPRING WHEAT AND BARLEY CROP GROWTH STAGE MODELS	ASSESS THE MODELS' ABILITY TO PREDICT CROP GROWTH STAGES ON A METEOROLOGICALLY DIFFERENT YEAR
MODEL FOR PREDICTION OF BIOWINDOW MIDPOINTS	DETERMINE WHETHER PLACEMENT OF ACQUISITIONS INTO BIOWINDOW/PERIODS IS ADEQUATE
RELATIONSHIP OF SPECTRAL SIGNATURES TO CROP GROWTH STAGE	VERIFY WHETHER METEOROLOGICAL MODELS SHOULD PREDICT CROP GROWTH STAGES OR BIOWINDOWS AS THE BASIS OF ACQUISITION DESIGNATION IN LABELING

9/23/81

AGGREGATION TO LARGE AREA EVALUATIONS

1981:

EVALUATION	PURPOSE
North Dakota Aggregation Logic Study	Conduct large area estimations using alternative area estimation components
* Four-State Aggregation Logic Study	Examine characteristics of large area estimation systems with alternative area estimation components
Grouping Approach Comparison	Determine whether the grouping of strata formed by SOAT for ratioing should be restricted
* Bonus	

9/28/81

AGGREGATION TO LARGE AREA EVALUATIONS (CONTINUED)

1982:

EVALUATION	PURPOSE
Comparison of Four Aggregation Components: - Single year simple ratioing - Multi-year simple ratioing - Single year GOAT (baseline) - Multi-year GOAT	Evaluate improvements made by the multi-year and GOAT subcomponents

9/28/81

DATA ASSESSMENT

M. M. SMYRSKI
9/23/81

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	SEGS.	YEAR(S)	DATE	TEST PERIOD	
									FROM	TO
	PILOT	SSG3B, SSG3C, SSG4	DATA	SUBSYSTEM	MN, MT. ND, SD, SASK.	365	1976 1977 1978 1979	9/28/81	10/80	9/81

DATA ASSESSMENT

- CRITERIA FOR SELECTION OF SEGMENTS FOR THE U.S./CANADA SPRING SMALL GRAINS PILOT EXPERIMENT.
  - 1976-1979 GROUND-TRUTH SEGMENTS FROM MINNESOTA, MONTANA, NORTH DAKOTA, SOUTH DAKOTA, AND SASKATCHEWAN (CANADA) WITH TWO OR MORE ACQUISITIONS.*
  - 1978 NONGROUND-TRUTH SEGMENTS FROM NORTH DAKOTA WITH TWO OR MORE ACQUISITIONS* (TO SUPPORT AGGREGATION).

- ORIGINAL CANDIDATE LIST 378
  - LOSS OF SEGMENTS IN CANADA FOR 1979 DUE TO RETRO-ORDER 12
  - LOSS OF ONE 1977 SEGMENT IN NORTH DAKOTA DUE TO CHANGE IN COORDINATES 1

CANDIDATE LIST = 365

*PROCESSABILITY DEFINITIONS IN PERFORMANCE EVALUATION STANDARDS.

9/28/81

DATA ASSESSMENT (Continued)

- ALLOCATION SCHEME OF SPRING WHEAT TO SUPPORT AGGREGATION STUDIES.
  - FY 1976 LARGE AREA CROP INVENTORY EXPERIMENT (LACIE) PHASE II
    - NEYMAN ALLOCATION TO COUNTIES BASED ON VARIABILITY OF TOTAL WHEAT ACREAGE.
  - FY 1977 LACIE PHASE III
    - NEYMAN ALLOCATION TO COUNTIES BASED ON VARIABILITY OF TOTAL WHEAT PRODUCTION.
  - FY 1978 LACIE TRANSITION YEAR (TY)
    - NEYMAN ALLOCATION TO REFINED STRATA BASED ON VARIABILITY OF TOTAL WHEAT PRODUCTION.
  - FY 1979
    - MAINTAINED GROUND-TRUTH SEGMENTS FROM 1978 IN NORTH DAKOTA AND MINNESOTA AND SIX SEGMENTS IN SOUTH DAKOTA AND TWO SEGMENTS IN MONTANA.

DATA ASSESSMENT (Continued)

- AGROMET CHARACTERISTICS FOR SPRING SMALL GRAINS TO SUPPORT SENSITIVITY STUDIES
  - FY 1976
    - DRIER THAN NORMAL THROUGHOUT THE YEAR FOR ALL STATES.
    - CROP GROWING SEASON STARTED EARLY IN NORTH DAKOTA, SOUTH DAKOTA, AND MINNESOTA AND REMAINED EARLY
    - CROP GROWING SEASON STARTED EARLY IN MONTANA AND ENDED NEAR NORMAL.
  - FY 1977
    - NEAR NORMAL MOISTURE THROUGHOUT THE YEAR FOR ALL STATES.
    - CROP GROWING SEASON STARTED EARLY FOR ALL STATES AND REMAINED EARLY.
  - FY 1978
    - NEAR NORMAL MOISTURE THROUGHOUT THE YEAR FOR ALL STATES.
    - CROP GROWING SEASON IN MINNESOTA TENDED TO BE NORMAL THROUGHOUT THE YEAR.
    - CROP GROWING SEASON IN NORTH DAKOTA, SOUTH DAKOTA, AND MONTANA WAS LATE THROUGHOUT THE YEAR.
    - COOL GROWING SEASON FOR ALL STATES
  - FY 1979
    - WETTER THAN NORMAL THROUGHOUT THE YEAR FOR ALL STATES.
    - CROP GROWING SEASON TENDED TO BE NORMAL TO LATE FOR ALL STATES.

FY 1981-82 FCPF U.S./CANADA PILOT EXPERIMENT SITES WITHIN THE U.S./CANADA SPRING WHEAT AREA

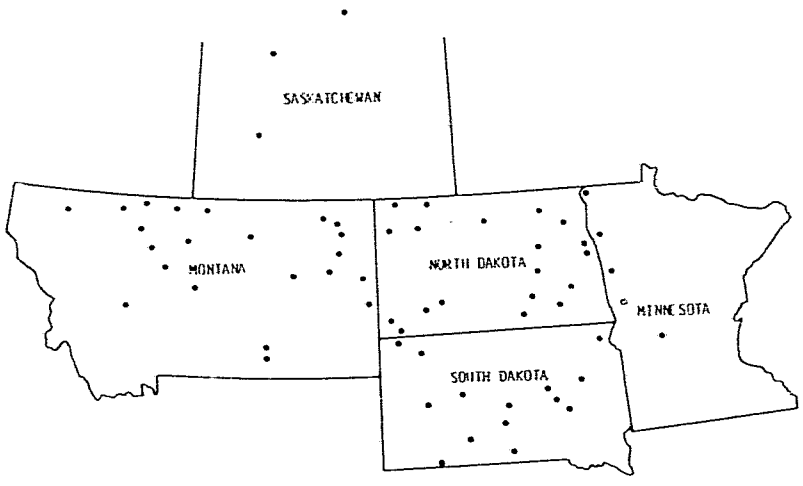
YEAR	NORTH DAKOTA	SOUTH DAKOTA	MINNESOTA	MONTANA	SASKATCHEWAN, CANADA	TOTAL
1976	19	14	5	22	3	63
1977	28	16	17	29	1	91
1978	29	11	15	15	15	85
1979	28	6	9	2	16	61
TOTAL	104	47	46	68	35	300
Nonground-Truth Segment for 1978						65
TOTAL SEGMENTS						365

9/28/81

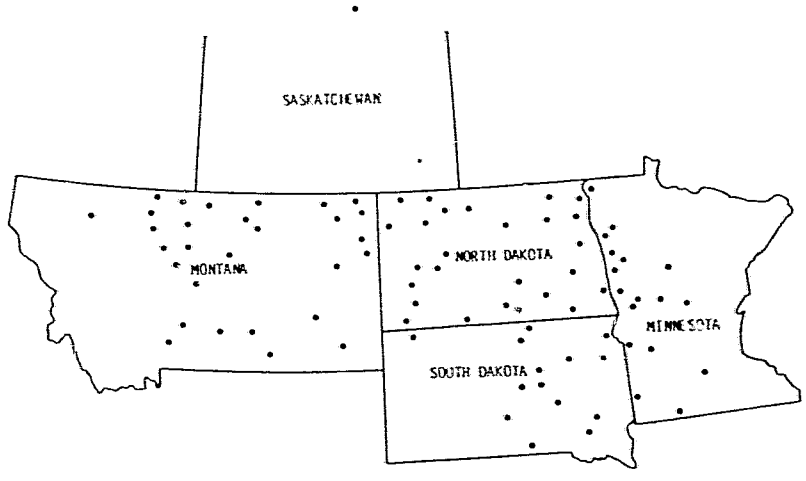
DATA ASSESSMENT (Continued)

SEGMENT LOCATION FOR U.S./CANADA SPRING SMALL GRAIN PILOT

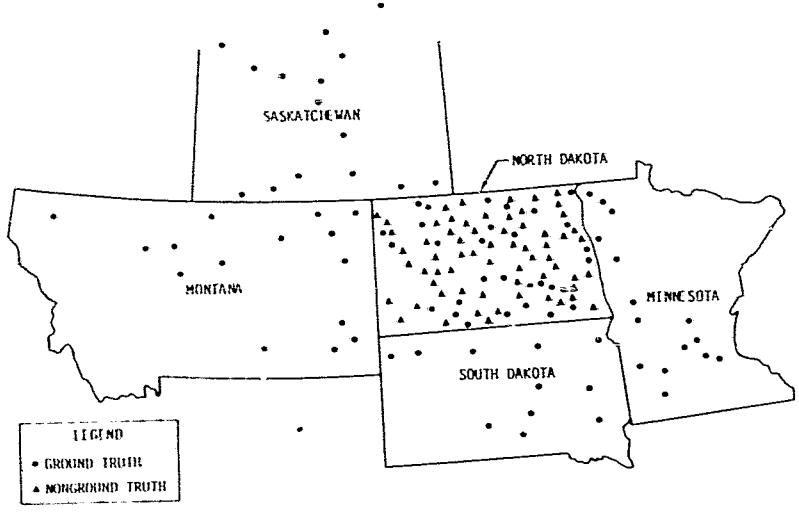
1976



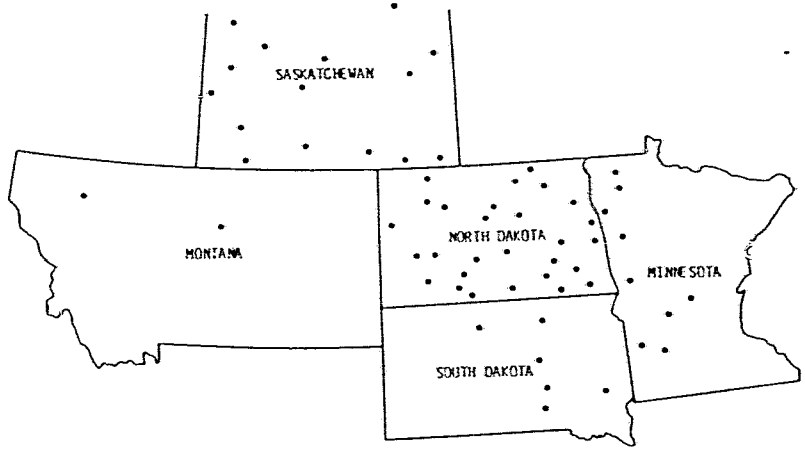
1977



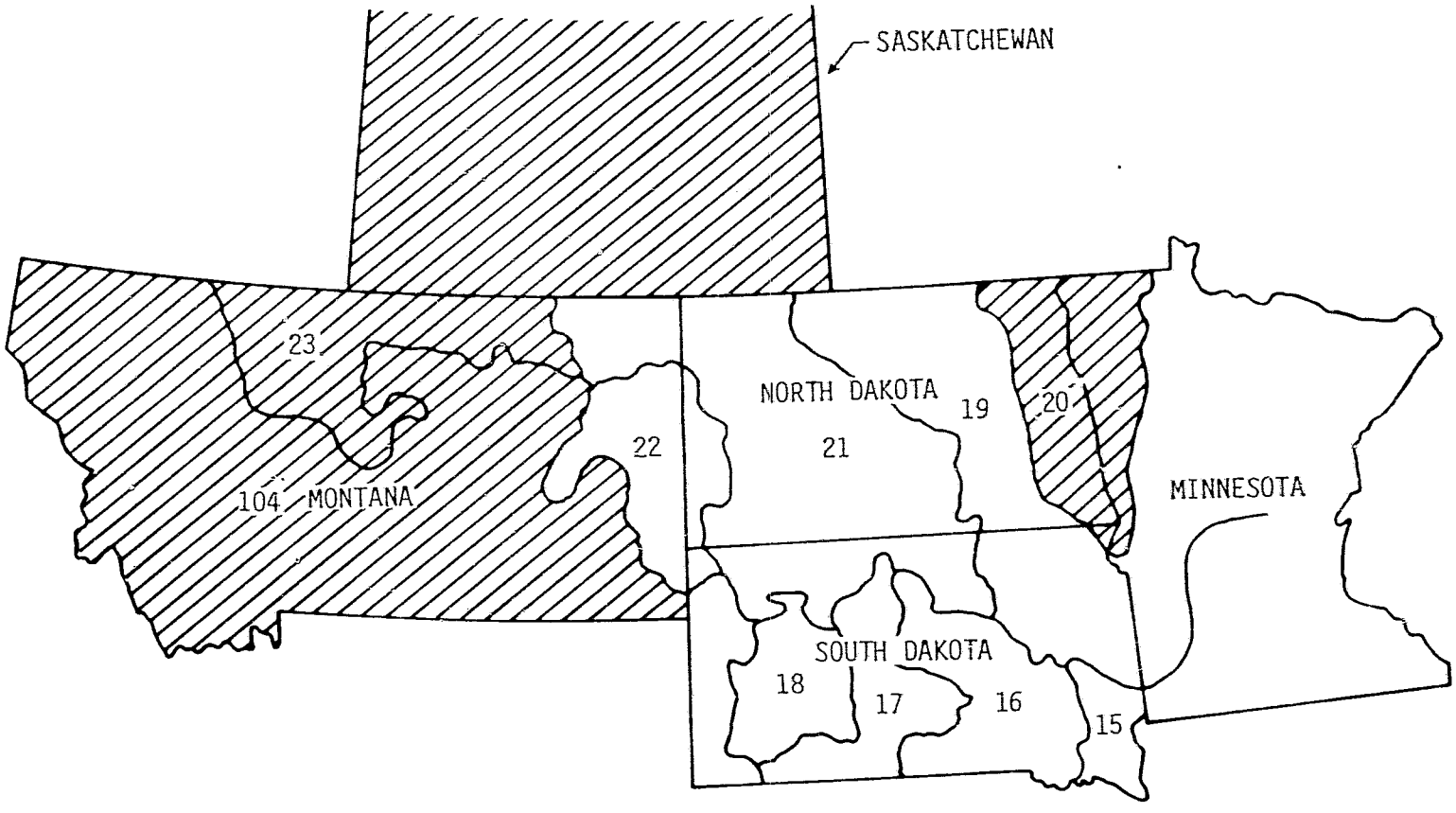
1978



1979



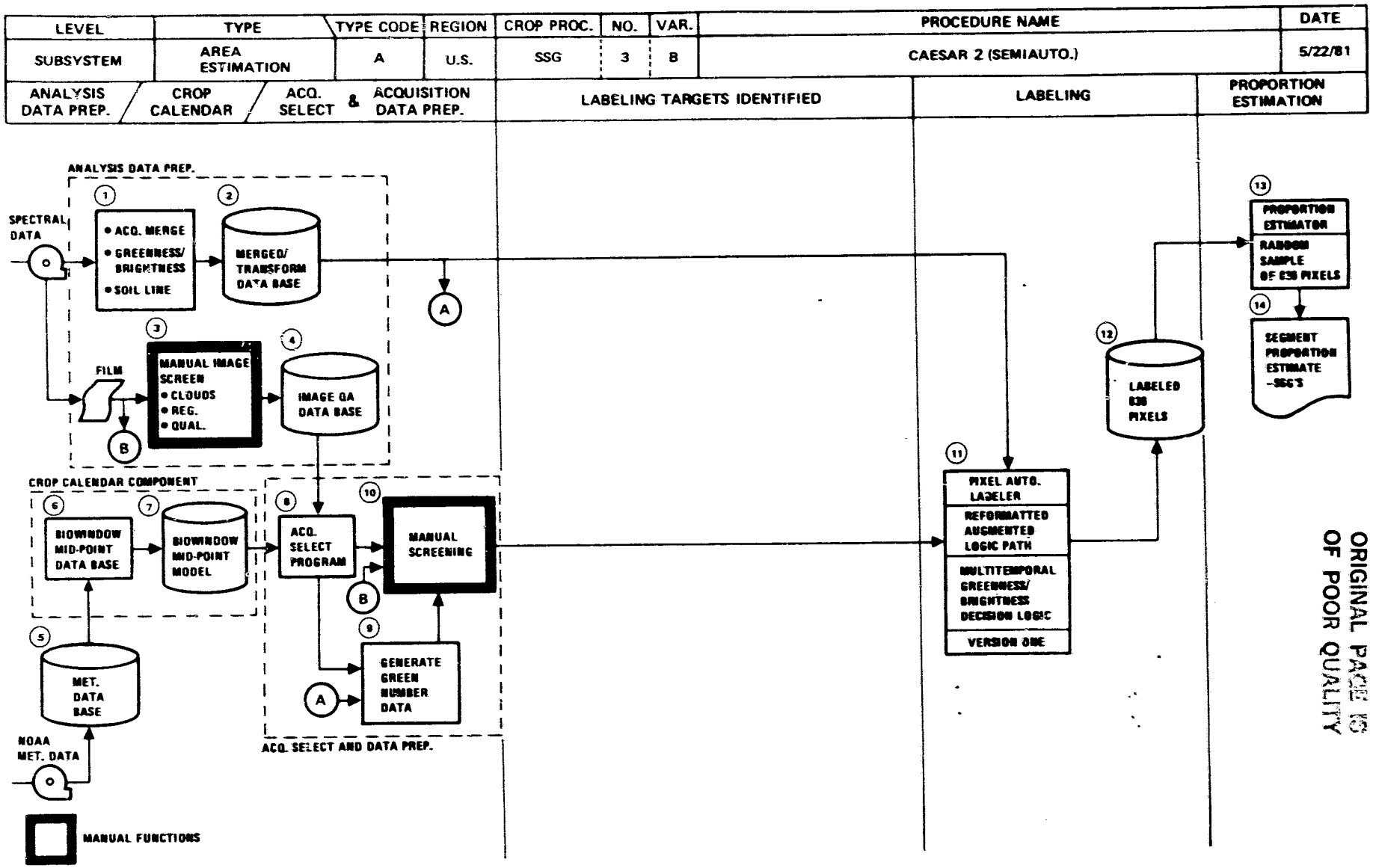
. 9/28/81



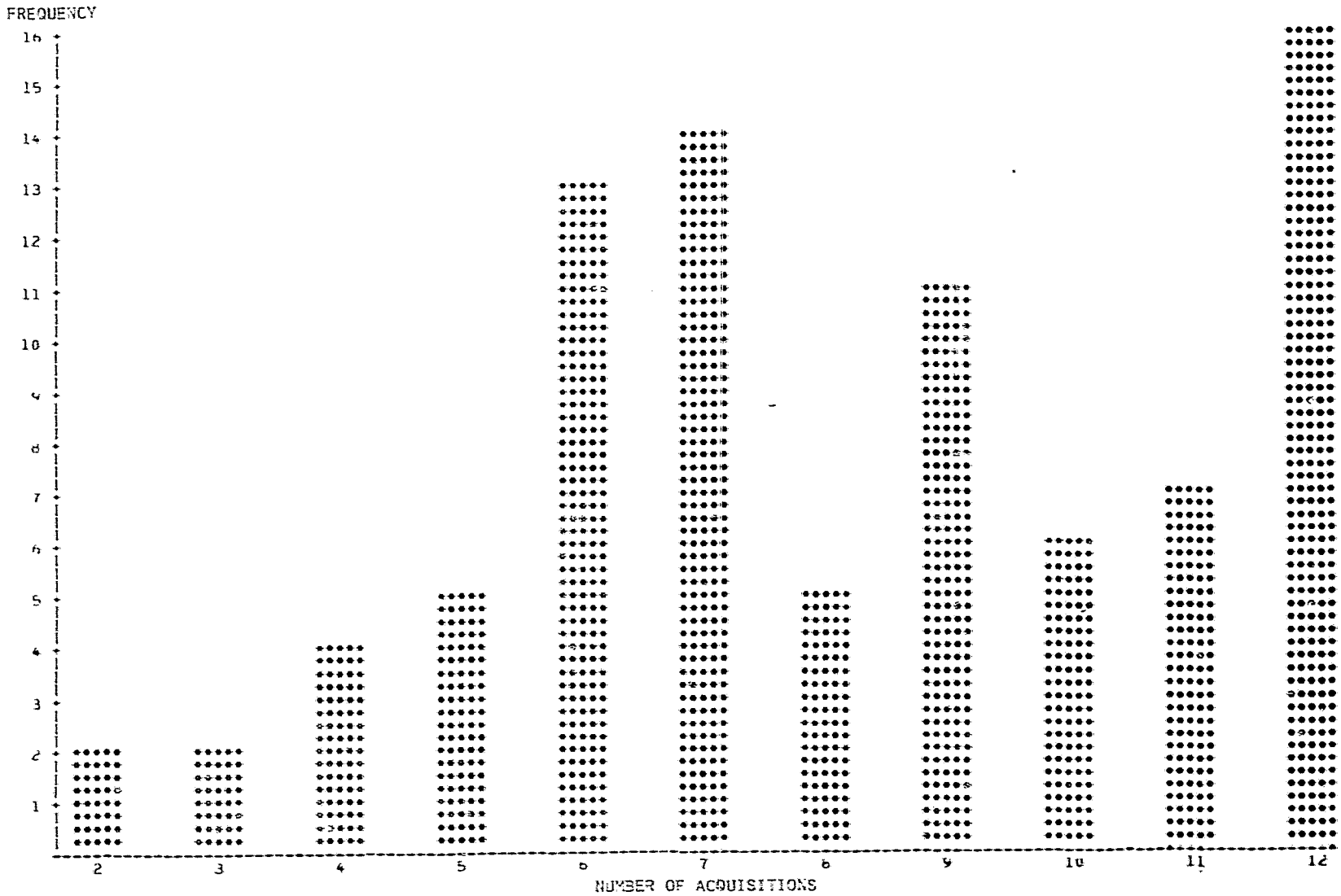
U.S.S.R. FOREIGN SIMILARITY REGION IN THE U.S./CANADA SPRING SMALL GRAINS PILOT EXPERIMENT

9/28/81

LEVEL	TYPE	TYPE CODE	REGION	CROP PROC.	NO.	VAR.	PROCEDURE NAME	DATE
SUBSYSTEM	AREA ESTIMATION	A	U.S.	SSG	3	B	CAESAR 2 (SEMIAUTO.)	5/22/81



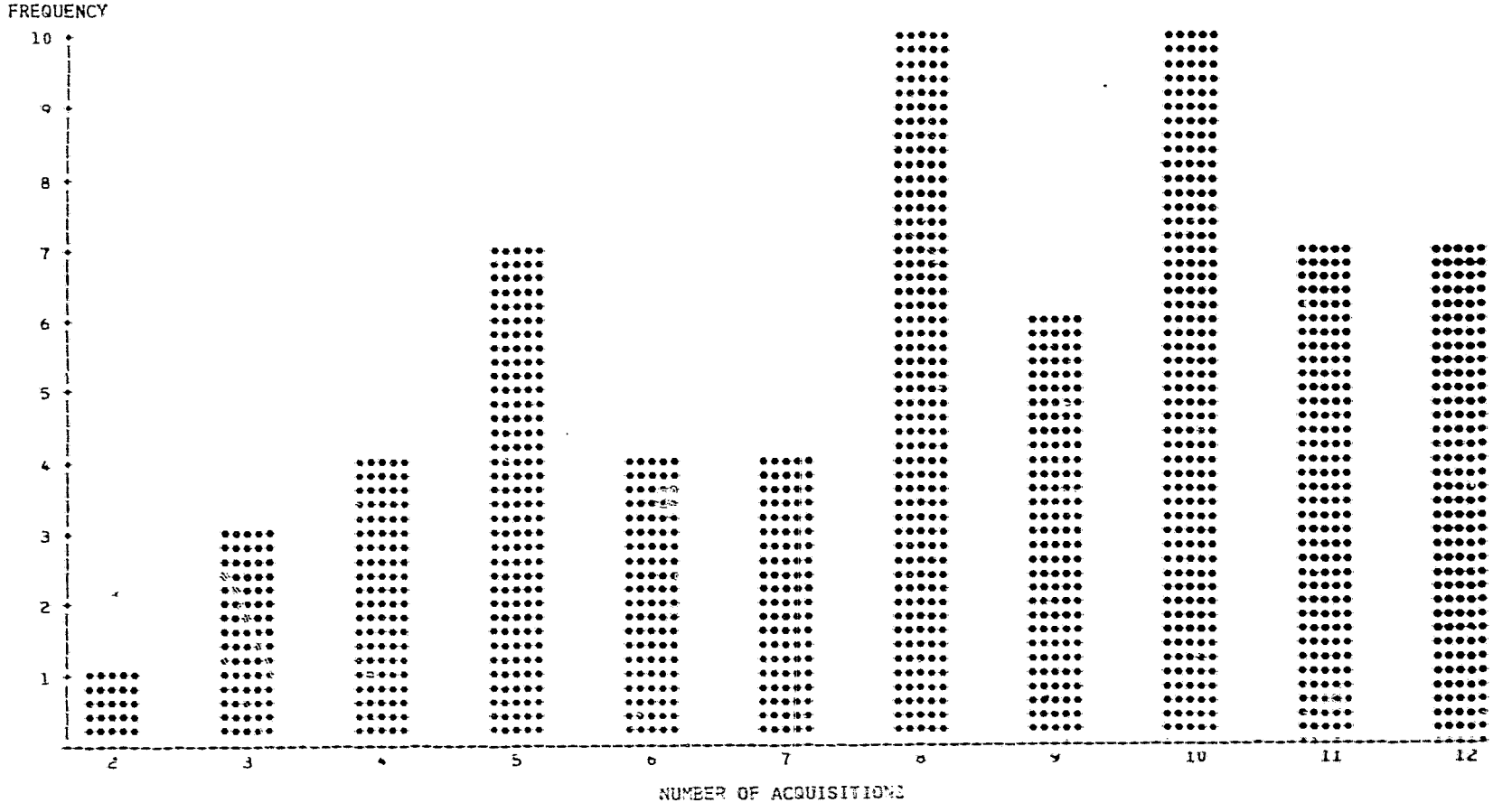
1978 GROUND-TRUTH DATA SET
FREQUENCY OF THE NUMBER OF ACQUISITIONS



9/28/81

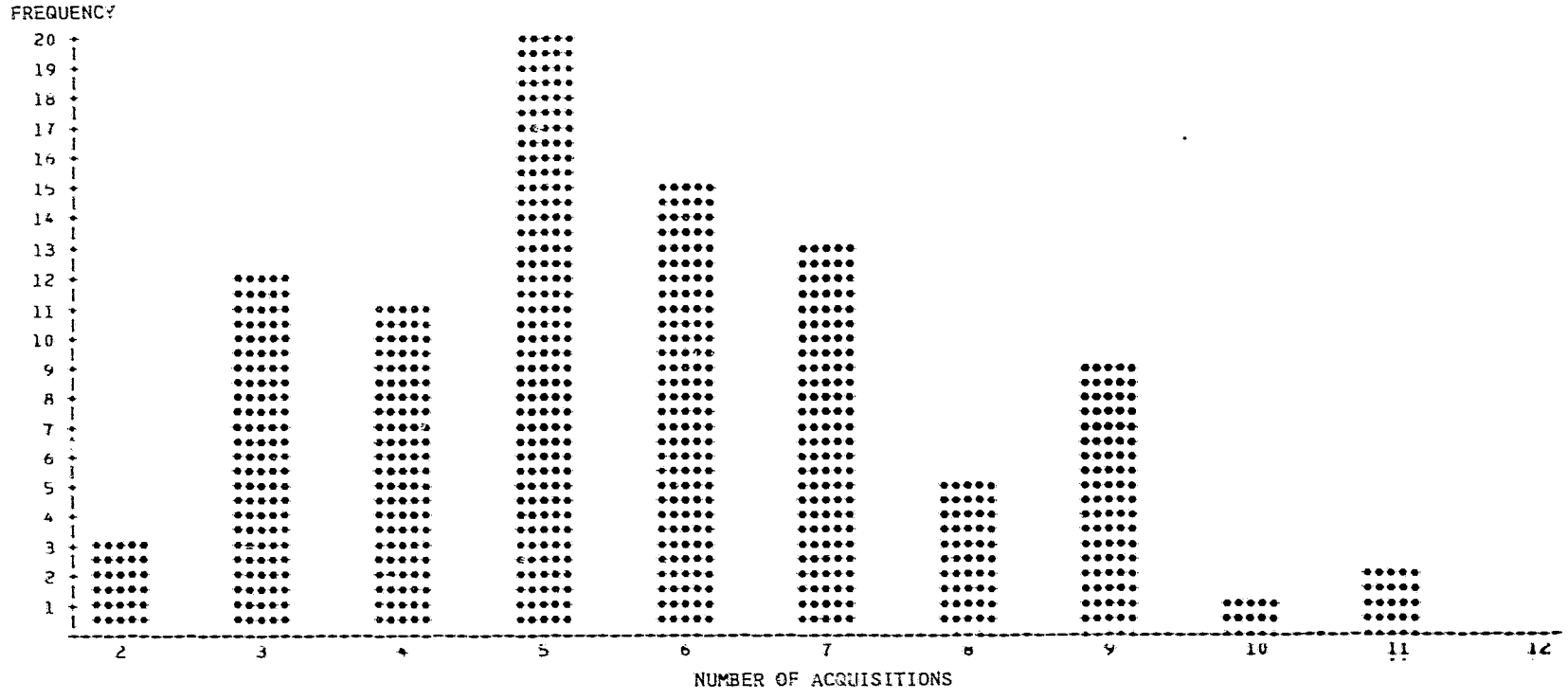
DATA ASSESSMENT (Continued)

1976 GROUND-TRUTH DATA SET
FREQUENCY OF THE NUMBER OF ACQUISITIONS



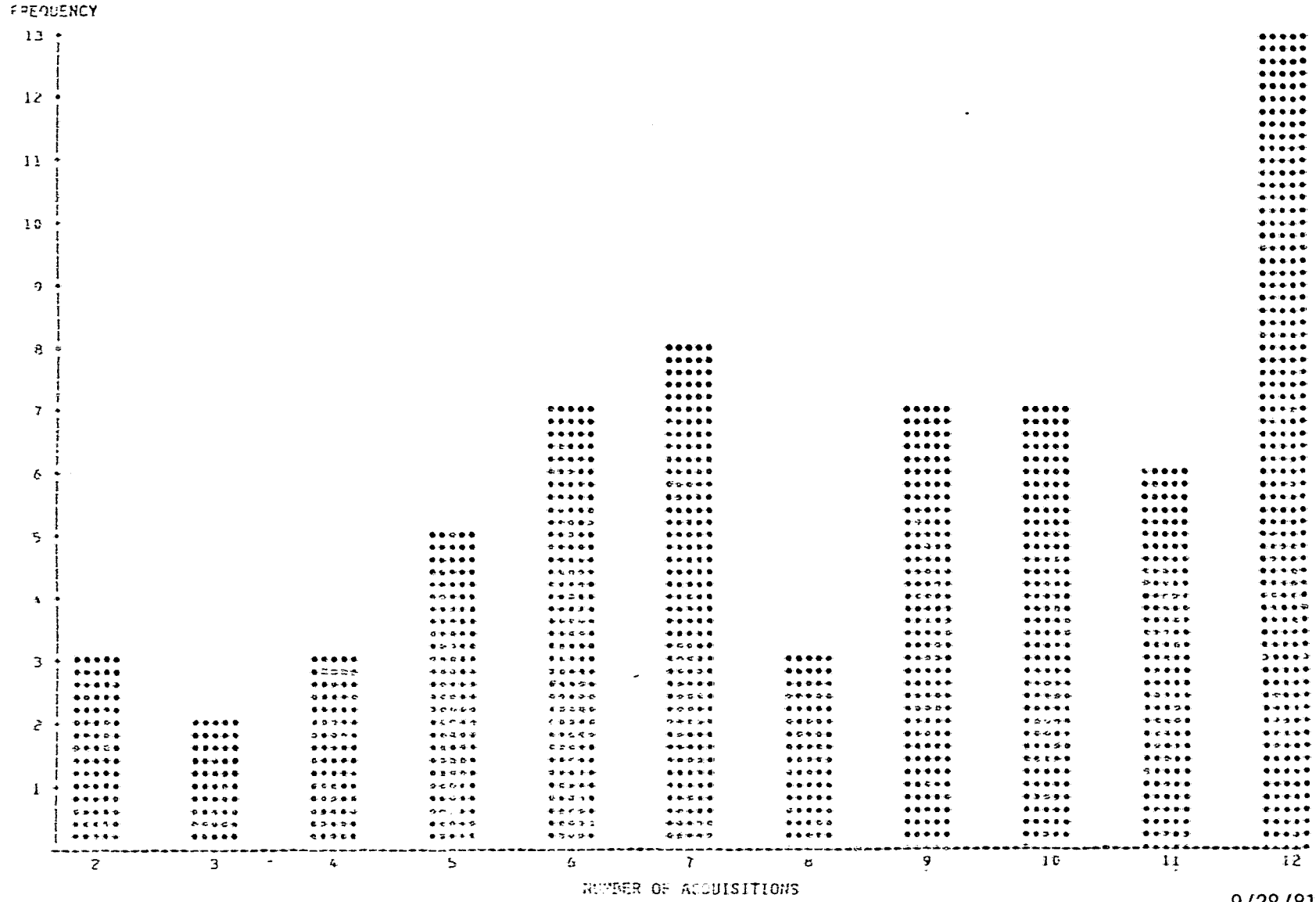
9/28/81

1977 GROUND-TRUTH DATA SET
FREQUENCY OF THE NUMBER OF ACQUISITIONS



9/28/81

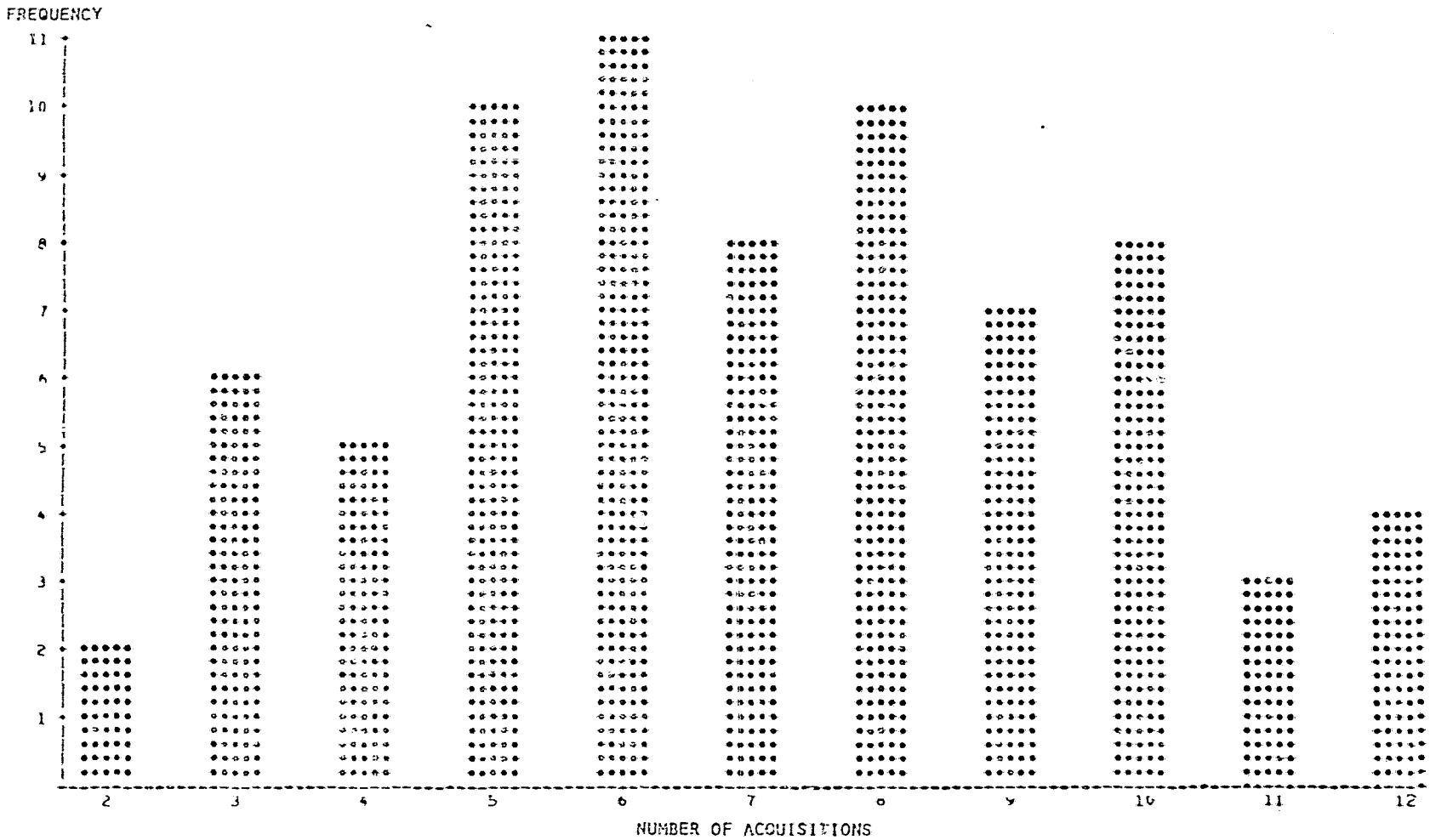
1978 NONGROUND-TRUTH DATA SET
FREQUENCY OF THE NUMBER OF ACQUISITIONS



9/28/81

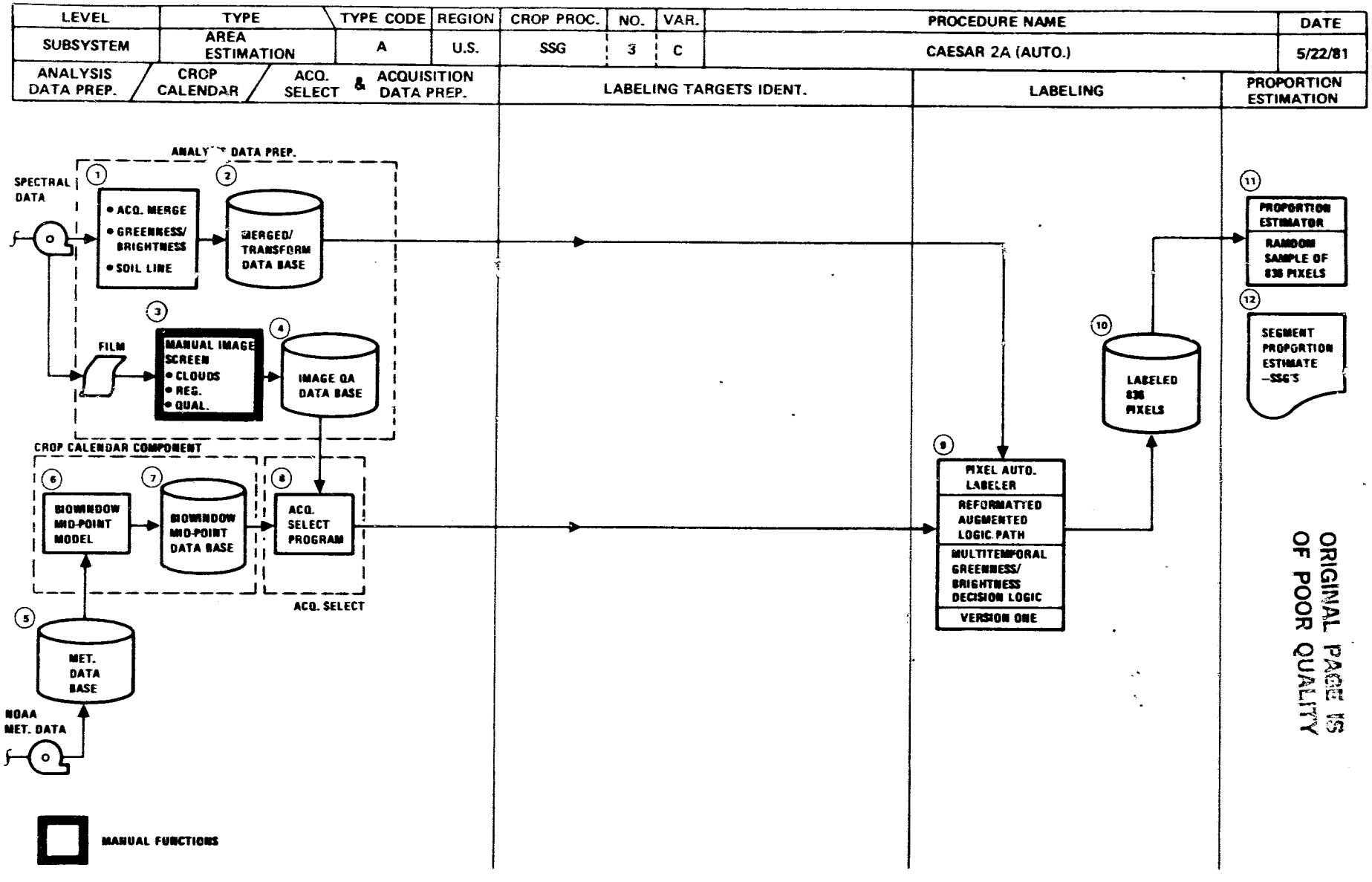
DATA ASSESSMENT (Concluded)

1979 GROUND-TRUTH DATA SET
FREQUENCY OF THE NUMBER OF ACQUISITIONS



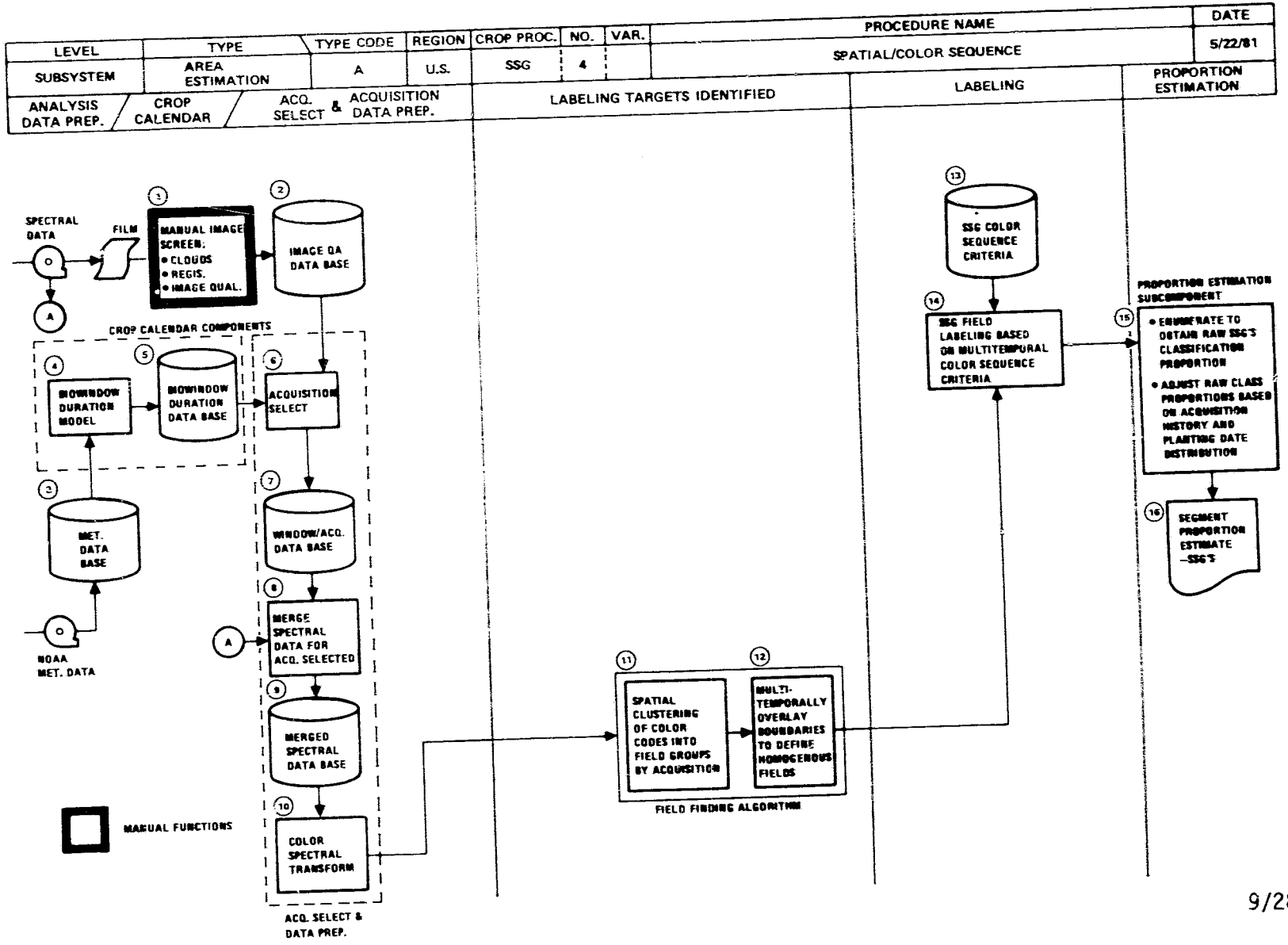
9/28/81

LEVEL	TYPE	TYPE CODE	REGION	CROP PROC.	NO.	VAR.	PROCEDURE NAME	DATE
SUBSYSTEM	AREA ESTIMATION	A	U.S.	SSG	3	C	CAESAR 2A (AUTO.)	5/22/81

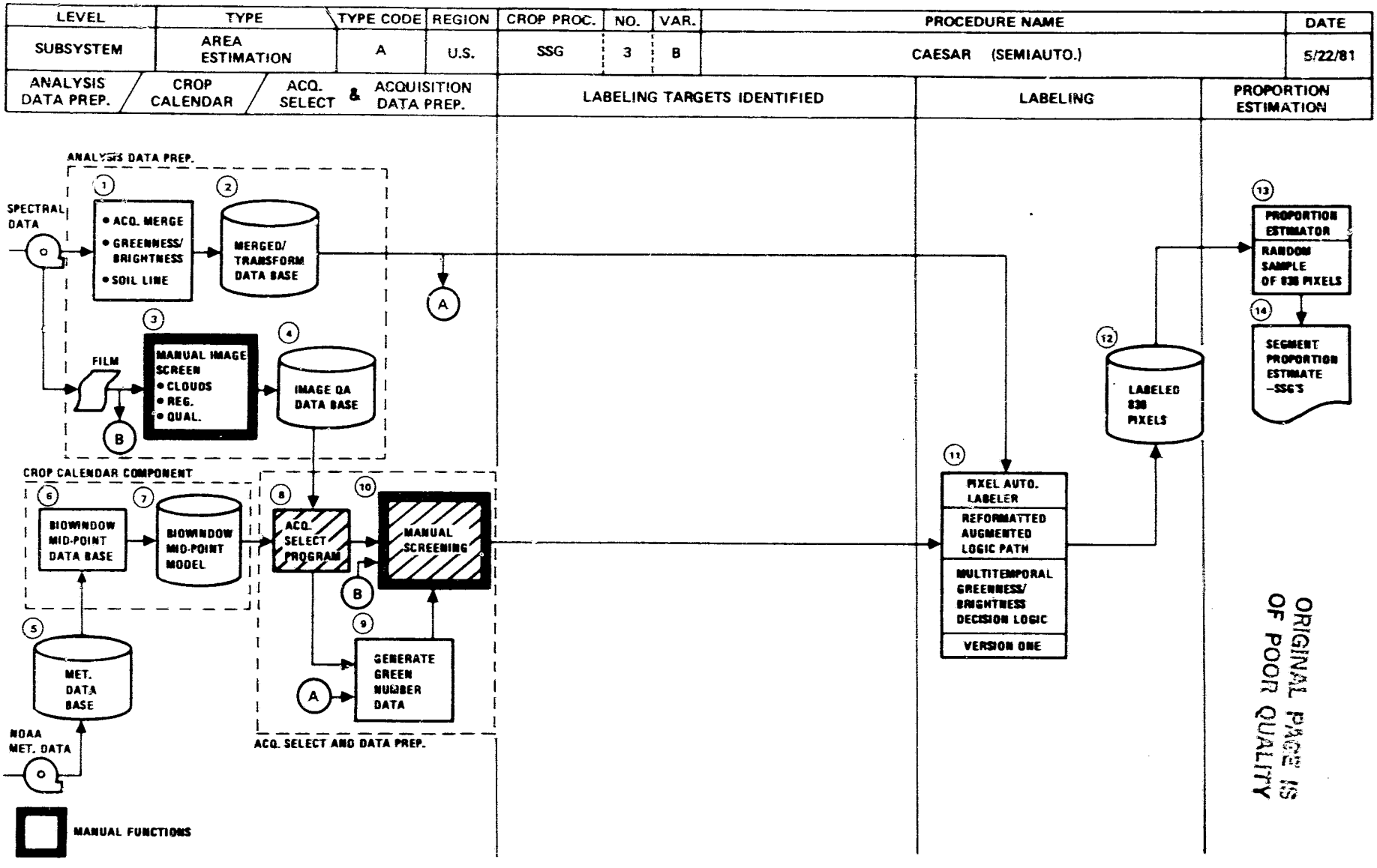


ORIGINAL PAGE IS OF POOR QUALITY

9/28/81

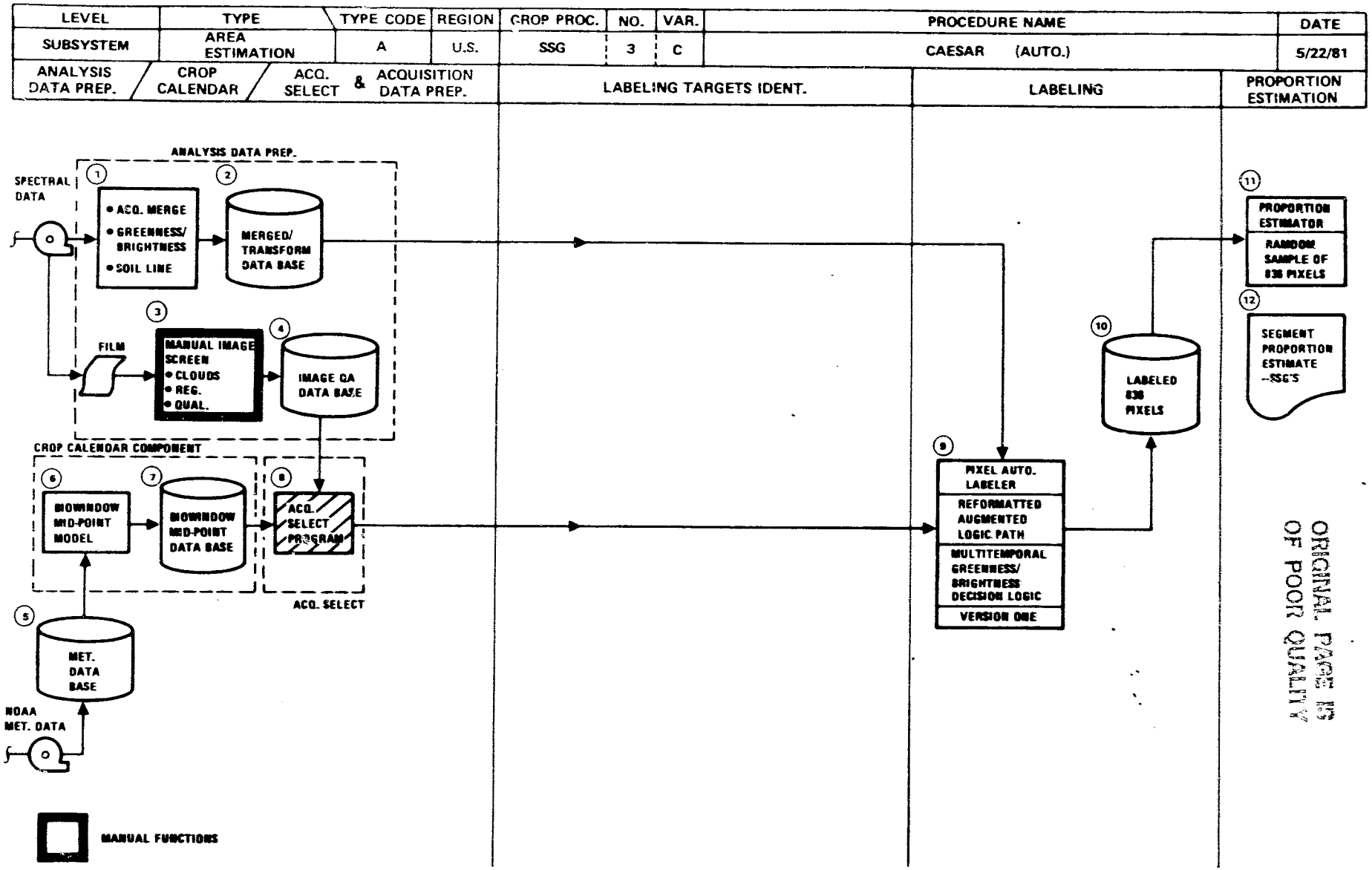


9/28/81



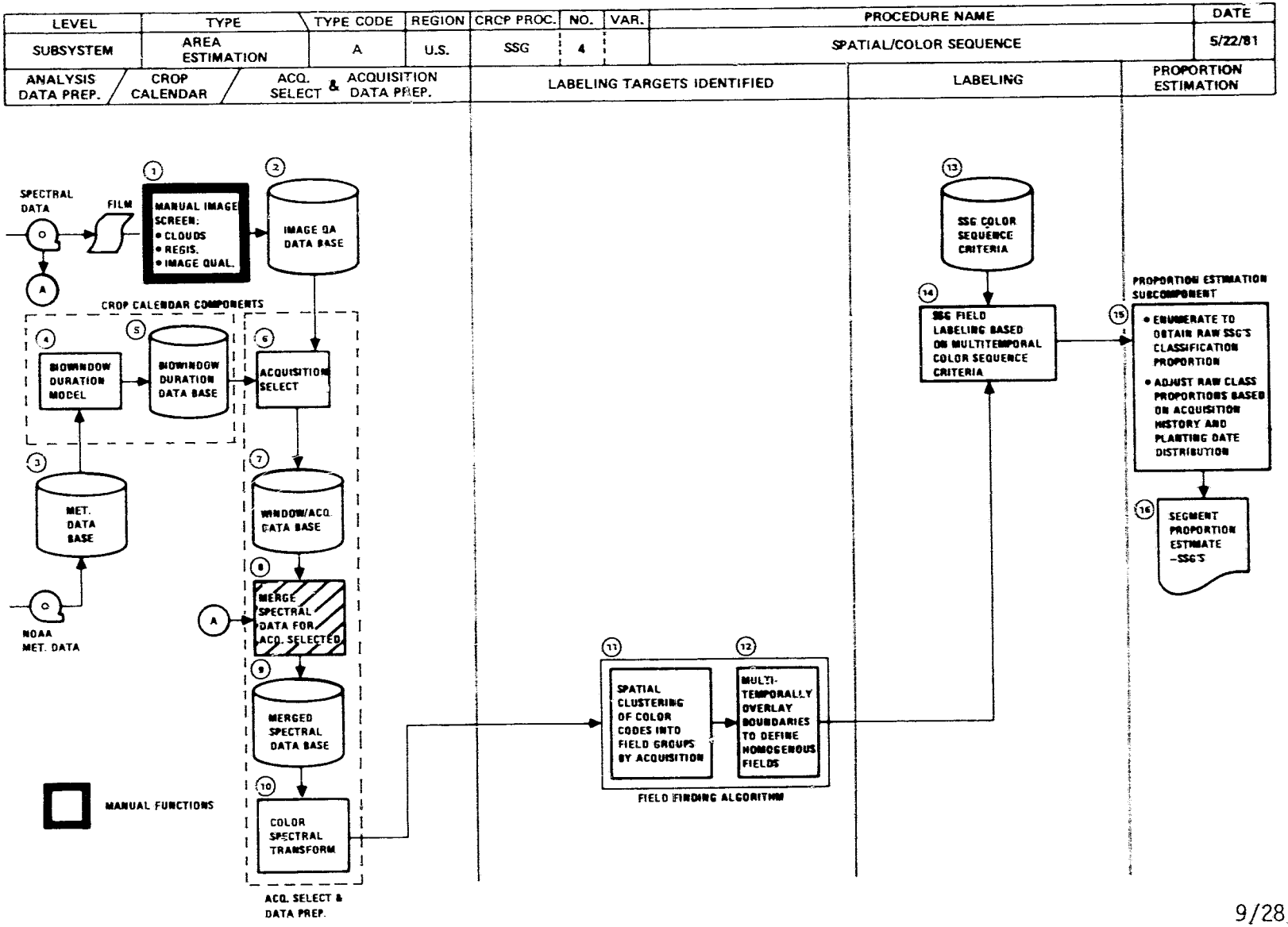
9/23/81

LEVEL	TYPE	TYPE CODE	REGION	CROP PROC.	NO.	VAR.	PROCEDURE NAME	DATE
SUBSYSTEM	AREA ESTIMATION	A	U.S.	SSG	3	C	CAESAR (AUTO.)	5/22/81



9/28/81

LEVEL	TYPE	TYPE CODE	REGION	CROP PROC.	NO.	VAR.	PROCEDURE NAME	DATE
SUBSYSTEM	AREA ESTIMATION	A	U.S.	SSG	4		SPATIAL/COLOR SEQUENCE	5/22/81



9/28/81

ACRES HARVESTED (IN THOUSANDS) FOR THE U.S. NORTHERN GREAT PLAINS
FOR YEARS 1976 - 1979 FOR SPRING SMALL GRAINS

	1976	1977	1978	1979	AVERAGE BY STATE OVER 1976 - 1979
MN	6,813 17.4%	6,682 17.4%	5,598 15.2%	4,787 13.6%	5,970 16.0%
MT	3,505 9.0%	3,690 9.6%	3,440 9.4%	3,915 11.1%	3,638 9.7%
ND	14,840 38.0%	13,180 34.2%	13,060 35.5%	11,970 34.0%	13,263 36.5%
SD	3,790 9.7%	5,576 14.5%	5,004 13.6%	4,653 13.2%	4,756 12.7%
TOTAL OVER ALL STATES	28,948 74.1%	29,128 75.6%	27,222 74.0%	25,325 71.0%	27,627 73.9%
TOTAL U.S.	39,085	38,515	36,798	35,234	37,408

DATA SYSTEMS

M.D. PORE
9/28/81

FCPF DATA SYSTEMS APPLICATIONS

- OBJECTIVES
- APPROACH
- CONFIGURATION
  - + FLOW
  - + PROCEDURES
- INTEGRATION
  - + DEVELOPMENTAL PROCESS
  - + SMALL GRAINS PILOT
  - + EXAMPLE PROCEDURE

FCPF Data Systems Applications - 2

OBJECTIVES:

A. IDENTIFY FCPF SOFTWARE AND COMPUTER DATA BASE REQUIREMENTS AND MONITOR DELIVERIES.

B. TO VERIFY THE INTEGRITY OF THE DATA BASES AND SOFTWARE IN SUPPORTING FCPF EXPERIMENT OBJECTIVES.

C. TO FACILITATE THE DELIVERY OF PROCEDURAL SOFTWARE TO EXPERIMENTS, THE ADAPTATION TO AN EXPERIMENTAL FORMAT, AND THE SMOOTH PROCESSING THEREAFTER.

FCPF Data Systems Applications - 3

APPROACH

A.1 Maintain an FCPF experiments association in order to identify requirements.

A.2 Document identified requirements and maintain a dialogue with provisioning sources to more clearly define requirements.

B.1 Define and document a set of FCPF standards and procedures for software, data bases, software configuration, discrepancy reporting, configuration change, software delivery, etc.

B.2 Maintain the FCPF applications configuration control system: accounts, verification files and records, etc.

B.3 Participate in discrepancy report (DR) resolution planning and implementation.

C.1 Set software delivery standards. Also when feasible, monitor and maintain standards for software development intended for delivery.

C.2 Identify software and data base interfaces, state programming requirements and coorindate supporting software development.

C.3 Participate in discrepancy report (DR) resolution planning and implementation.

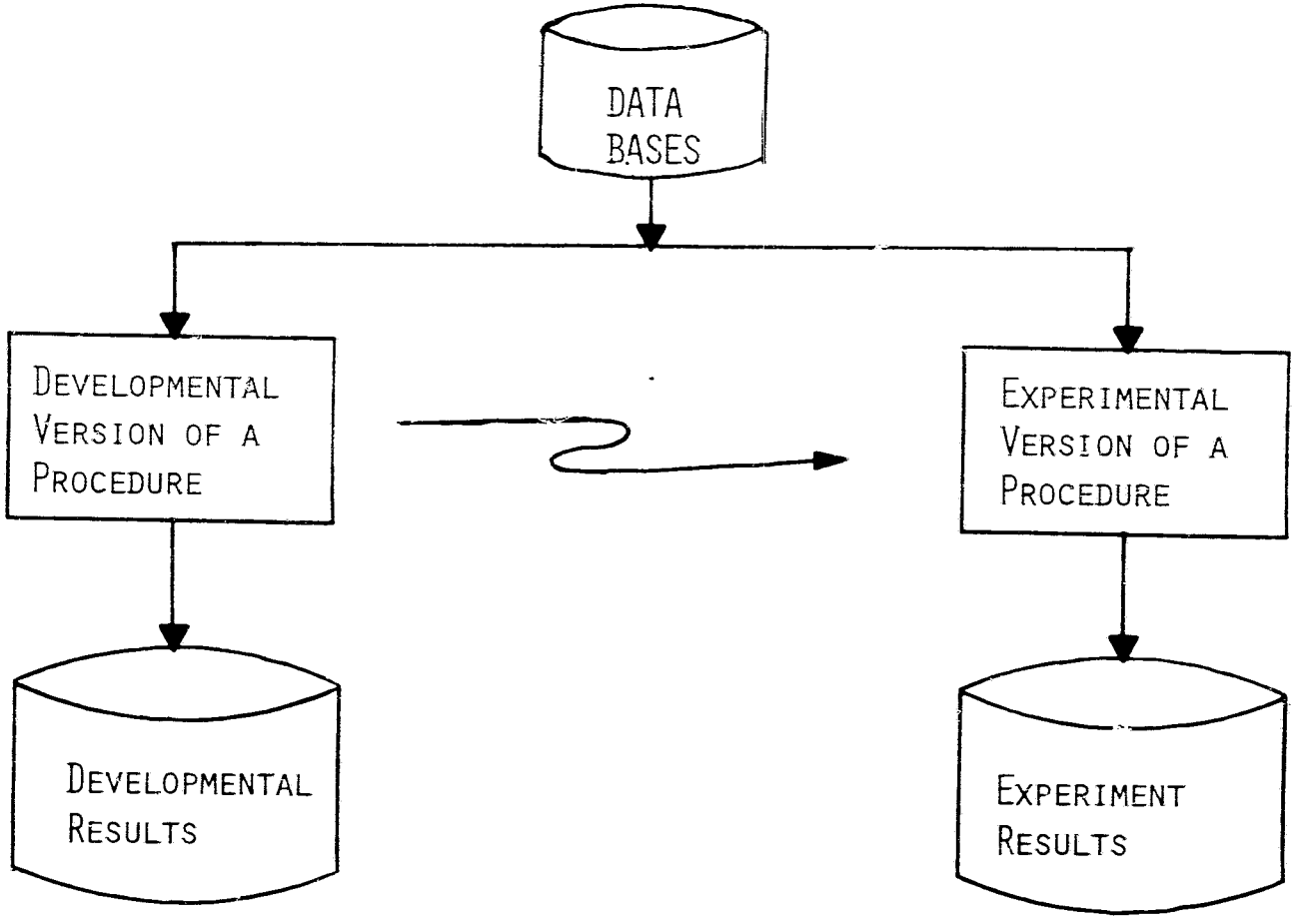
CONFIGURATION CONTROL DOCUMENTATION

- TECHNICAL DESCRIPTION: FUNCTIONAL DESIGN, LOGICAL FLOW CHARTS, ETC.
- SOFTWARE DESCRIPTION: SUBROUTINE INTERFACES, PROCESSING FLOW CHARTS, ETC.
- USER'S GUIDE: AT THE LEVEL OF THE TARGETED IMPLEMENTER
- PROGRAM LISTING: HARDCOPY FOR A BACKUP
- VERIFICATION DATA SET AND APPROPRIATE RESULTS: COMPARISON OF FUTURE CHANGES
- VERIFICATION TEST SCRIPT: INFORMAL PLAN

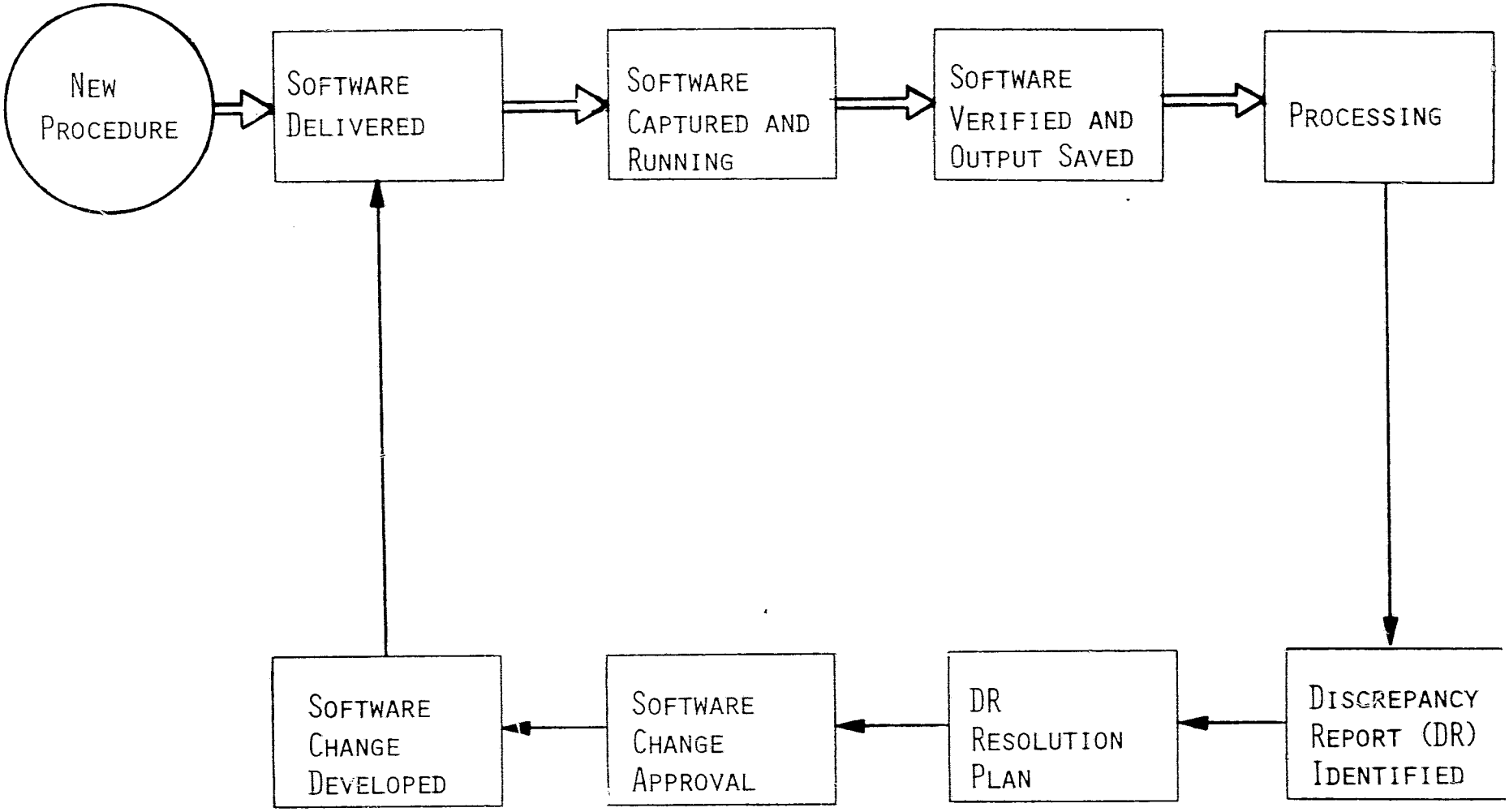
FCPF PROCEDURES REQUIRING CONFIGURATION

SSG2: BASELINE	(LARS)
SSG3B: SEMI-AUTO CAESAR	(LARS)
SSG3C: AUTOMATED CAESAR	(LARS)
SSG4: SPATIAL/COLOR SEQUENCE	(EODLS)
GROUPED OPTIMAL AGGREGATION TECHNIQUE	(EODLS)
MULTI-YEAR AGGREGATION COMPONENT	(EODLS)

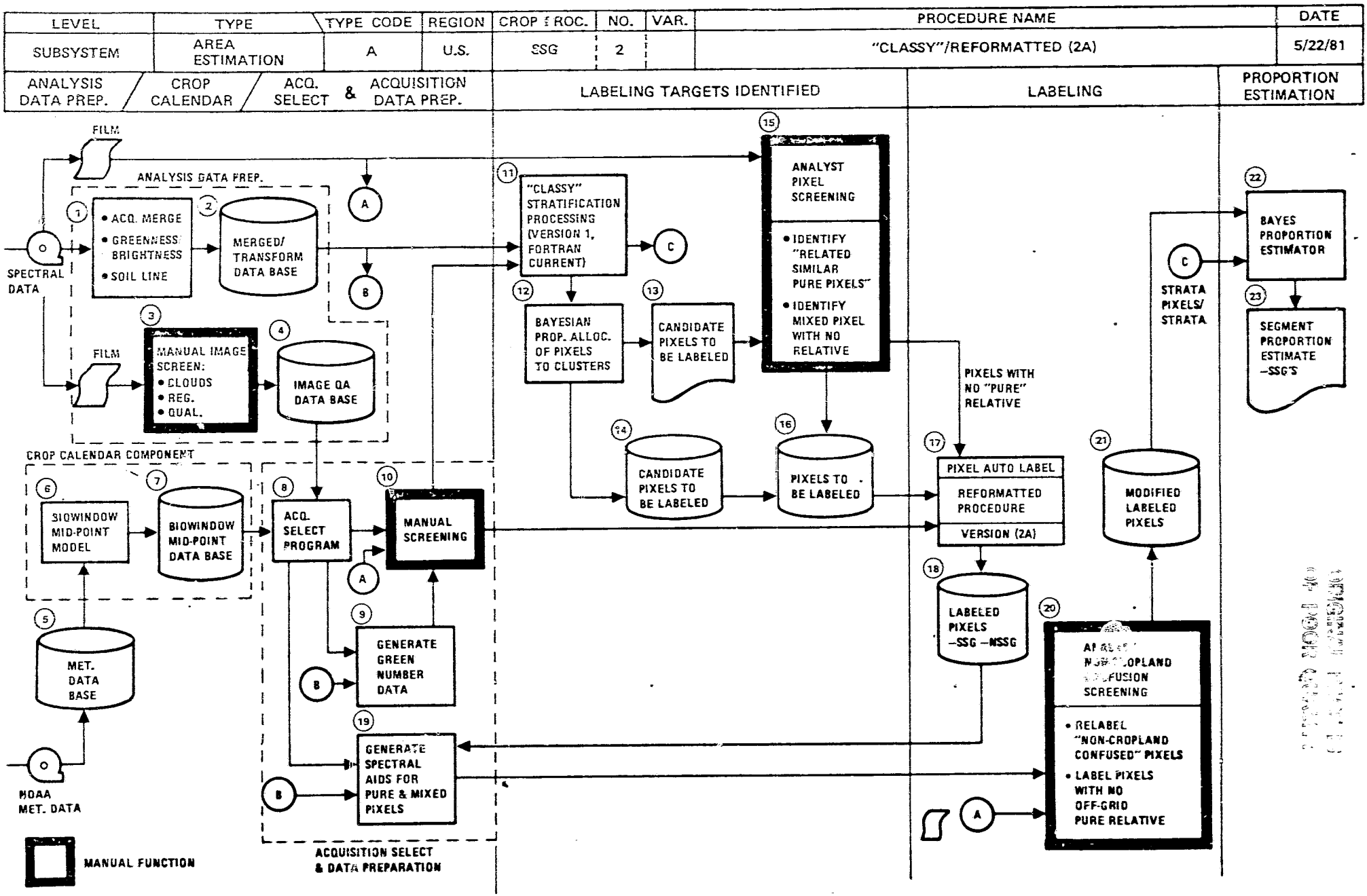
DATA SYSTEMS DEVELOPMENTAL PROCESS



CONFIGURATION CONTROL FLOW

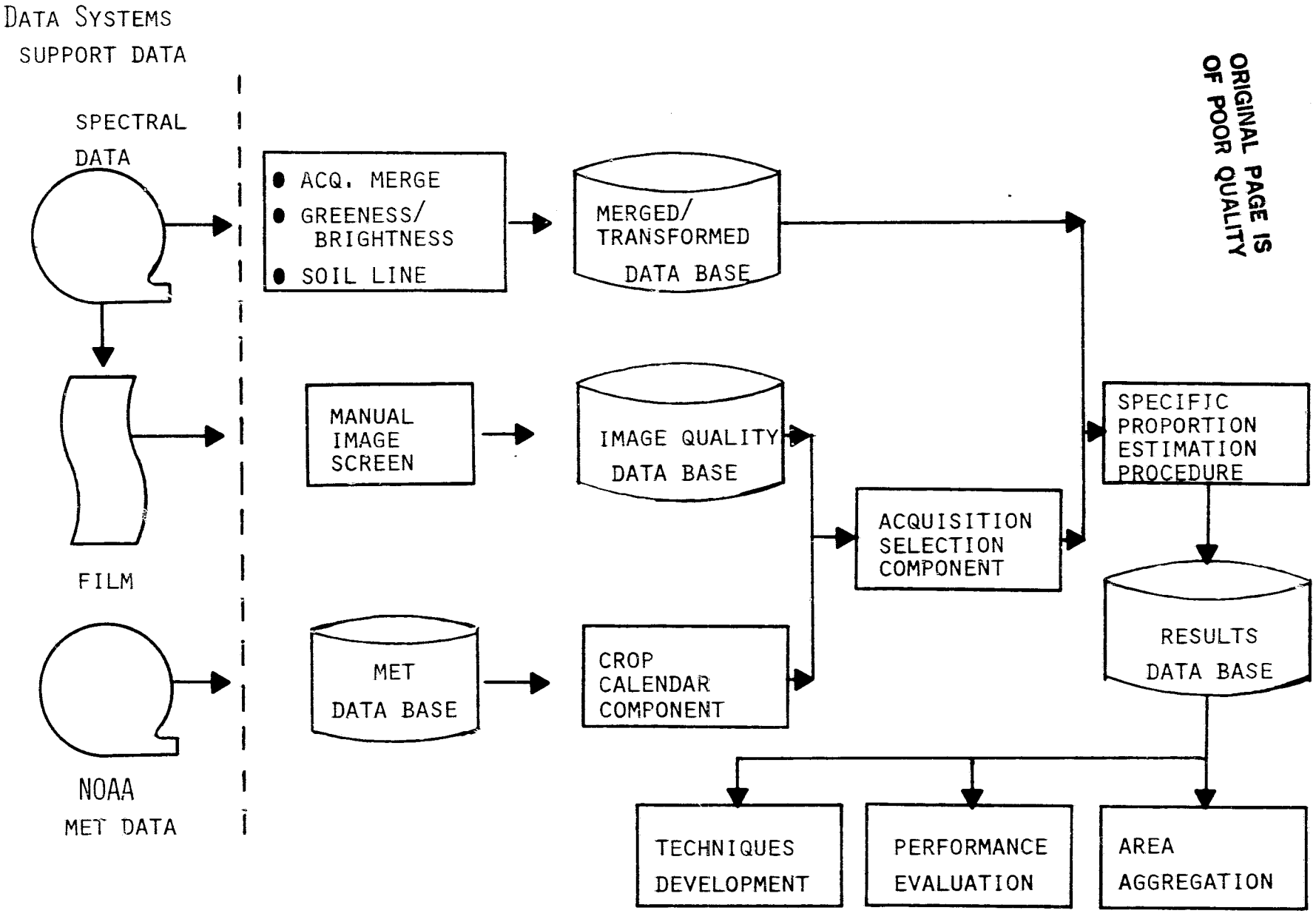


LEVEL	TYPE	TYPE CODE	REGION	CROP PROC.	NO.	VAR.	PROCEDURE NAME	DATE
SUBSYSTEM	AREA ESTIMATION	A	U.S.	SSG	2		"CLASSY"/REFORMATTED (2A)	5/22/81



DATA SYSTEMS INTEGRATION FOR THE SMALL GRAINS PILOT

FCPF APPLICATIONS SOFTWARE AND DATA BASES



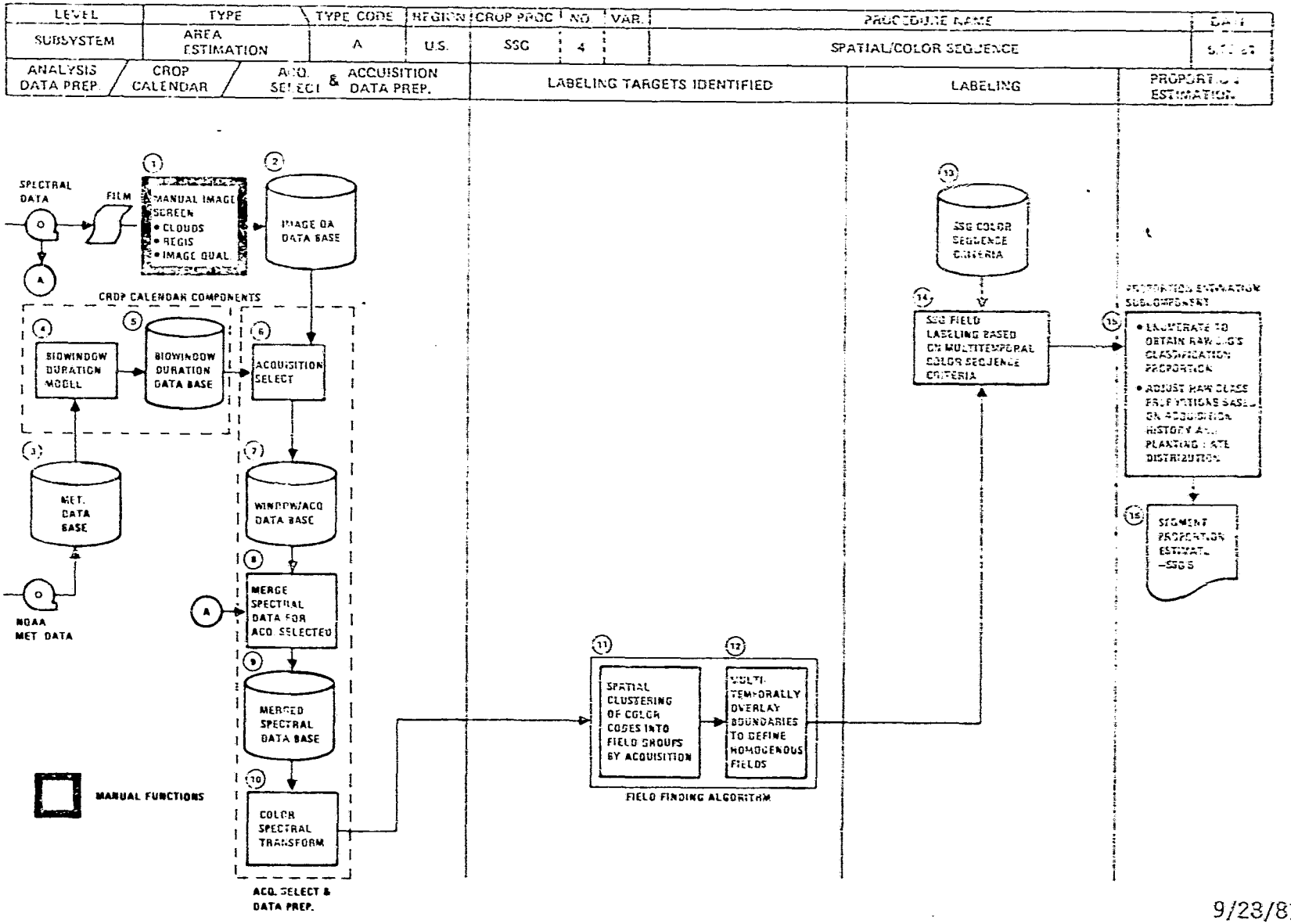
INTEGRATION AND COORDINATION ACCOMPLISHMENTS

- THE EXPERIMENTAL SYSTEMS WERE DESIGNED IN A MODULAR FORMAT.
  - + ALL SYSTEMS USING COMMON COMPONENTS
  - + FACILITATES TESTING OF COMPONENTS AND POSSIBLE ALTERNATES
  - + PROVIDES THE MECHANISM FOR CROP ESTIMATION AND PERFORMANCE MEASUREMENT. TIMELINESS, COST EFFECTIVENESS, AFFORDABILITY, ETC
  - + PROVIDES THE "BUILDING BLOCKS" FOR CONSTRUCTING NEW SYSTEMS FROM RECENT DEVELOPMENTS AND OPTIMAL COMPONENTS
- FOUR MAJOR APPLICATIONS DATA BASES WERE DEVELOPED AND MAINTAINED BY FCPF.
  - + THESE DATA BASES SUPPORT —
    - - CURRENT AND FUTURE EXPERIMENTS
    - - TECHNIQUES DEVELOPMENT
    - - LONG-TERM EVALUATION AND TESTING IN EXPERIMENTS
- INTEGRATION AND COORDINATION OF MODULES AND DATA BASES WITHIN AND BETWEEN SYSTEMS MAINTAINED EXPERIMENT INTEGRITY AND RELIABLE RESULTS DELIVERIES TO —
  - + PERFORMANCE EVALUATION
  - + AGGREGATION
  - + TECHNIQUES DEVELOPMENT

4.0 PRELIMINARY RESULTS

PROPORTION ESTIMATION TECHNOLOGY

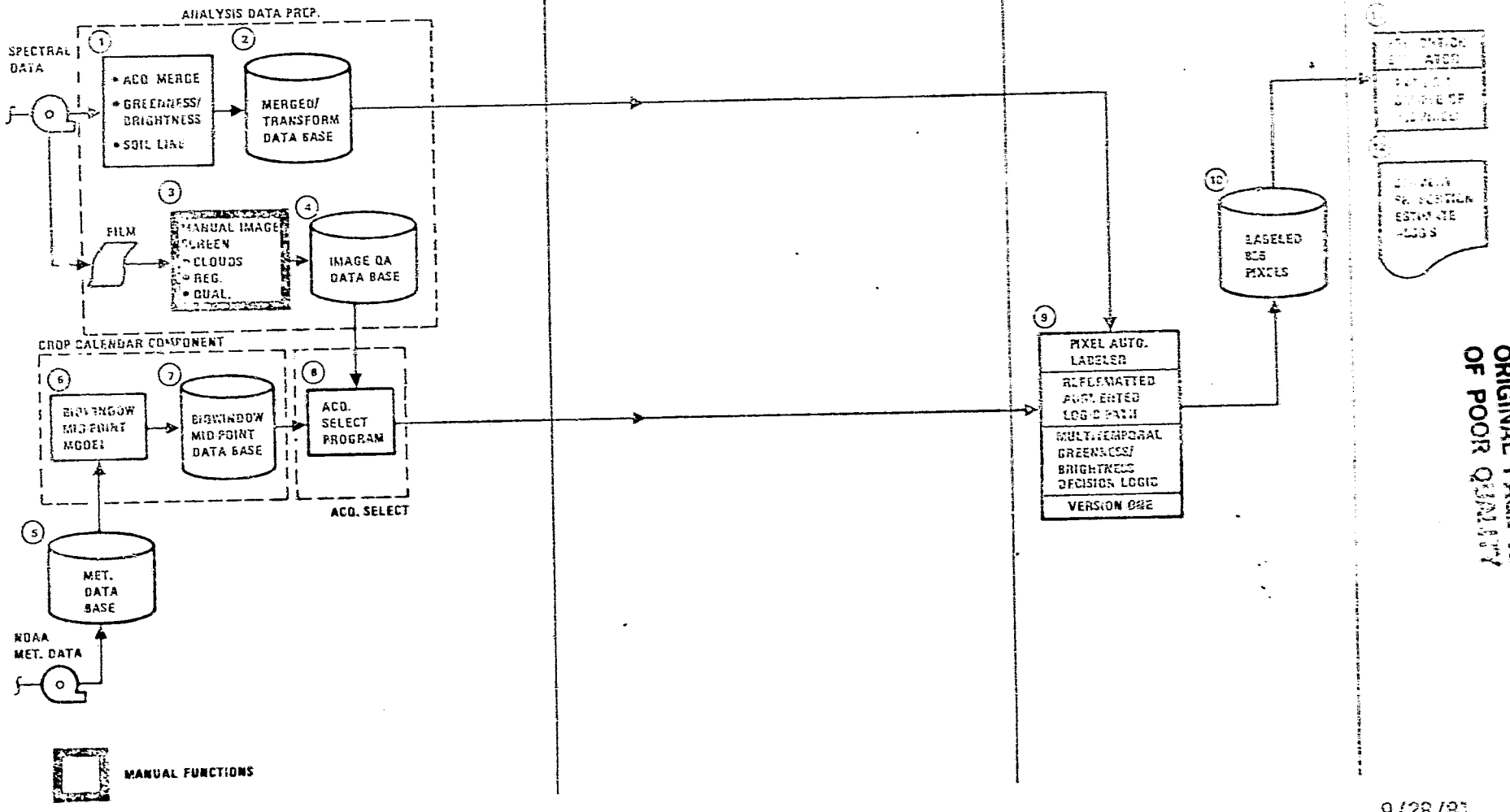
D. T. REGISTER
9/28/81


LEVEL
SUBSYSTEM
TYPE
AREA ESTIMATION
TYPE CODE
A
REGION
U.S.
CROP PROC
SSG
NO
4
VAR.
PROCEDURE NAME
SPATIAL/COLOR SEQUENCE
ANALYSIS DATA PREP.
CROP CALENDAR
ACQ. SELECT & ACQUISITION DATA PREP.
LABELING TARGETS IDENTIFIED
LABELING
PROPORTION ESTIMATION
SPECTRAL DATA
FILM
MANUAL IMAGE SCREEN
• CLOUDS
• REGIS
• IMAGE QUAL
IMAGE DA DATA BASE
CROP CALENDAR COMPONENTS
BIOWINDOW DURATION MODEL
BIOWINDOW DURATION DATA BASE
ACQUISITION SELECT
MET. DATA BASE
WINDOW/ACQ DATA BASE
NOAA MET DATA
MERGE SPECTRAL DATA FOR ACQ. SELECTED
MERGED SPECTRAL DATA BASE
COLOR SPECTRAL TRANSFORM
MANUAL FUNCTIONS
ACQ. SELECT & DATA PREP.
SPATIAL CLUSTERING OF COLOR CODES INTO FIELD GROUPS BY ACQUISITION
MULTI-TEMPORALLY OVERLAY BOUNDARIES TO DEFINE HOMOGENOUS FIELDS
FIELD FINDING ALGORITHM
SSG COLOR SEQUENCE CRITERIA
SSG FIELD LABELING BASED ON MULTITEMPORAL COLOR SEQUENCE CRITERIA
PROPORTION ESTIMATION SUBCOMPONENT
• ENUMERATE TO OBTAIN RAW CLASSIFICATION PROPORTION
• ADJUST RAW CLASS PROPORTIONS BASED ON ACQUISITION HISTORY AND PLANTING DATE DISTRIBUTION
SEGMENT PROPORTION ESTIMATE -SSGS

9/23/81

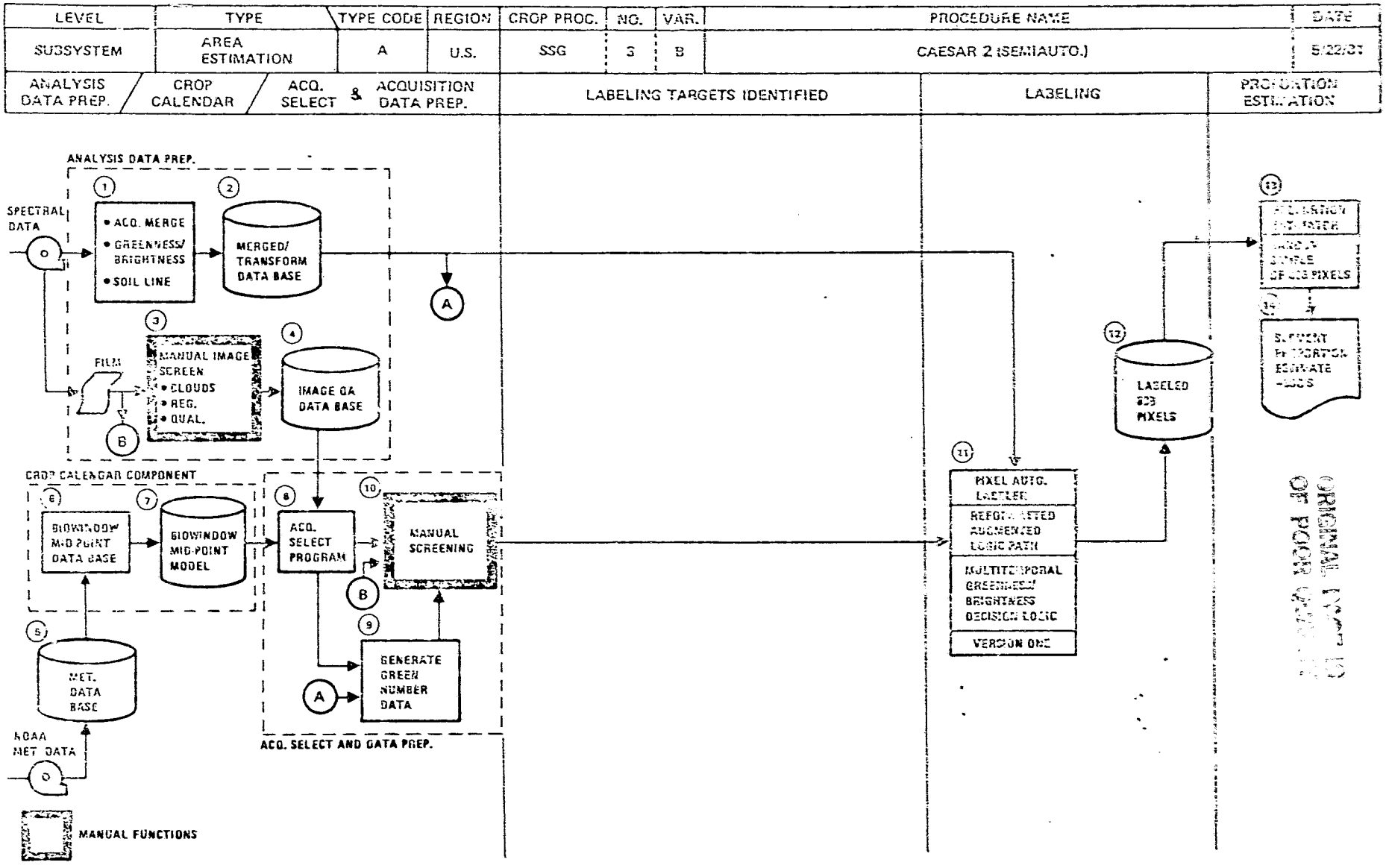
LEVEL	TYPE	TYPE CODE	REGION	CROP PROC.	NO.	VAR.	PROCEDURE NAME	DATE
SUBSYSTEM	AREA ESTIMATION	A	U.S.	SSG	3	C	CAESAR 2A (AUTO.)	5/22/81

ANALYSIS DATA PREP. / CROP CALENDAR / ACQ. SELECT & ACQUISITION DATA PREP.	LABELING TARGETS IDENT.	LABELING	PROPORTION ESTIMATION

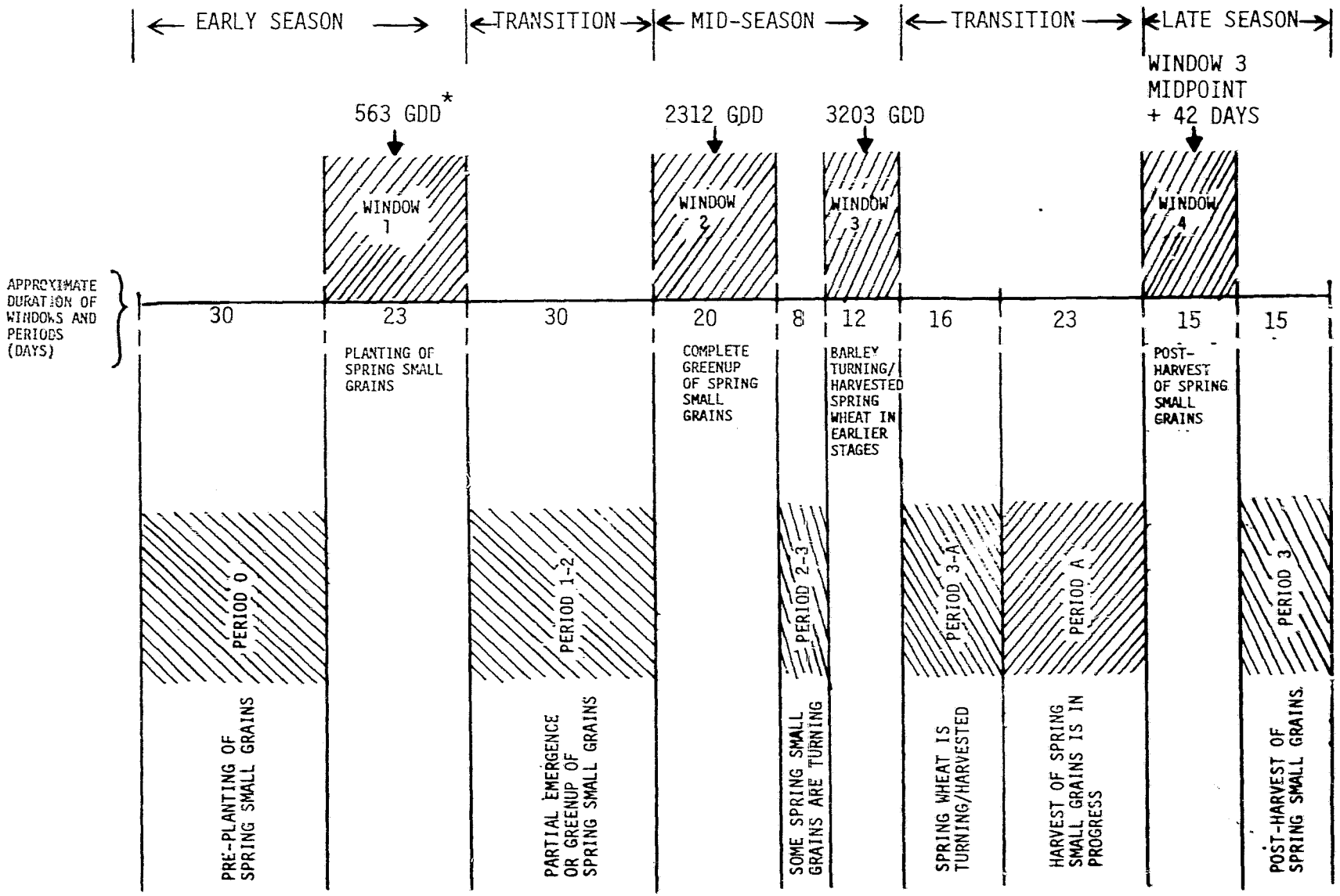


9/28/81

LEVEL	TYPE	TYPE CODE	REGION	CROP PROC.	NO.	VAR.	PROCEDURE NAME	DATE
SUBSYSTEM	AREA ESTIMATION	A	U.S.	SSG	3	B	CAESAR 2 (SEMIAUTO.)	5/22/81

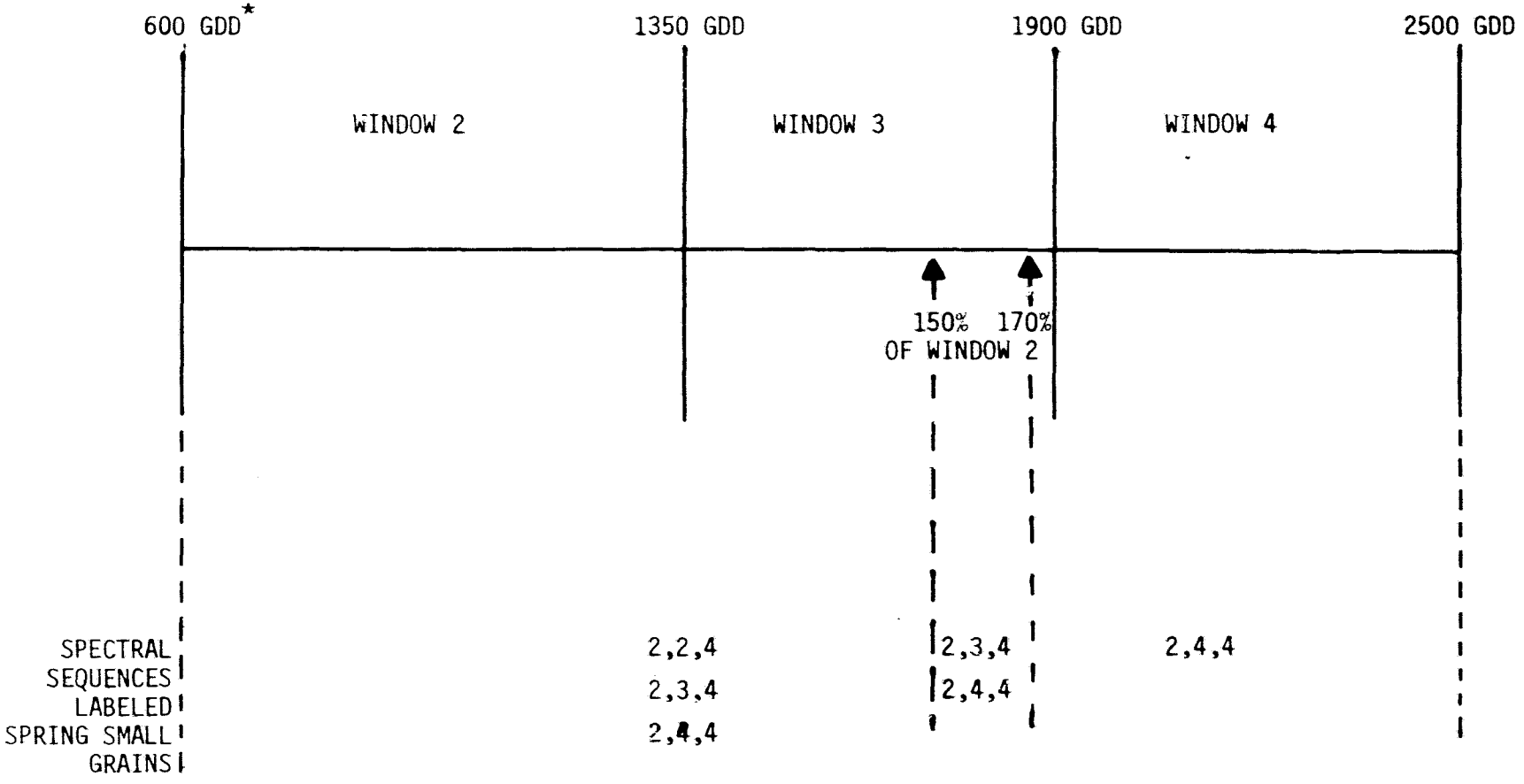


RELATIONSHIP BETWEEN WINDOW/PERIODS USED IN SSG3B AND SSG3C



*GDD = Growing degree days with base $32^{O}F$.

RELATIONSHIP BETWEEN WINDOWS USED IN SSG4



SELECTION OF SEQUENCES DEPENDENT UPON DATE OF SECOND ACQUISITION USED

*GDD = Growing degree days based on the interval 50^{o} to 86^{o}F.

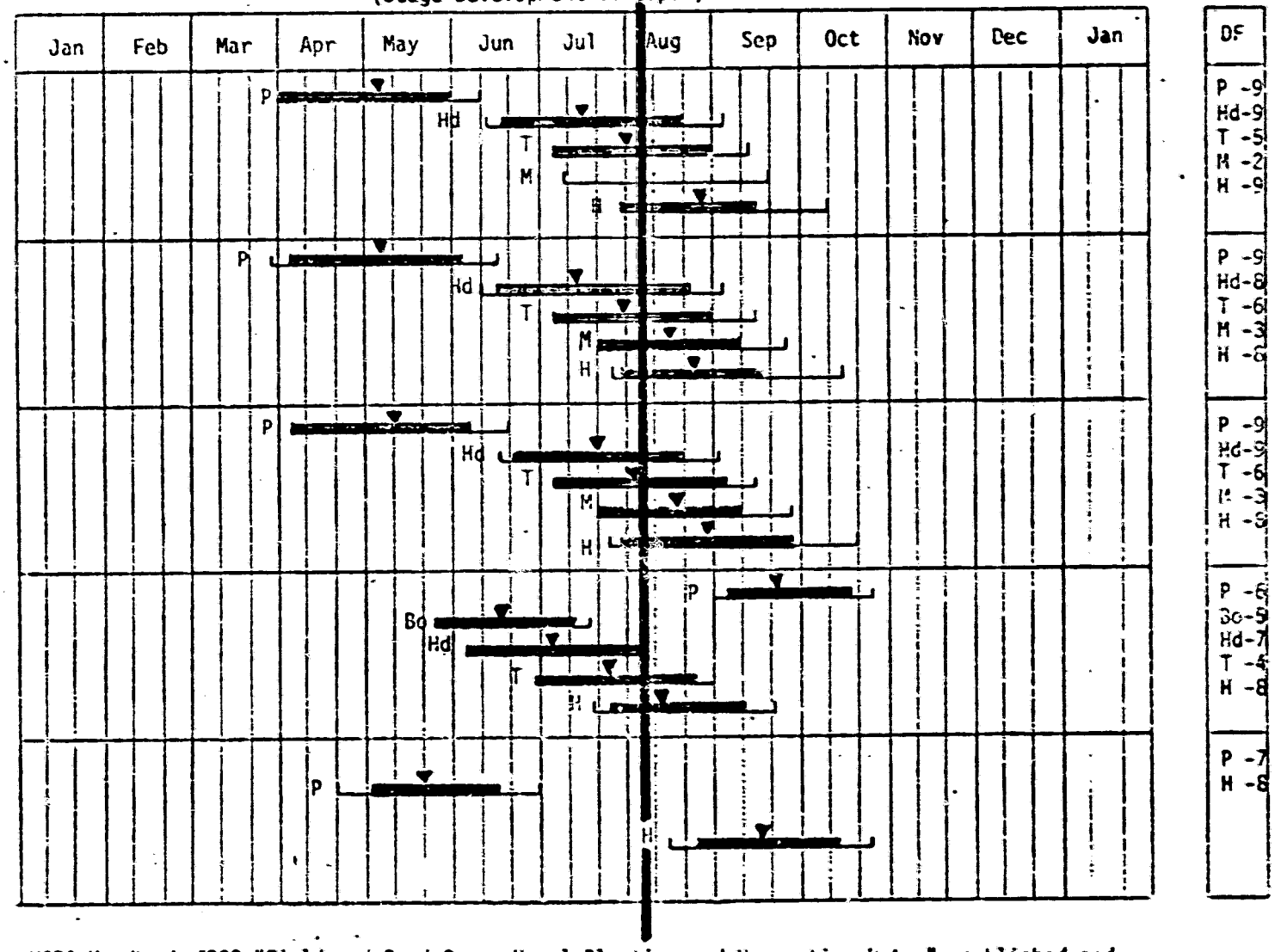
Area UNITED STATES

Date 6 DECEMBER 1979

Col/Sub MONTANA

CROP CALENDAR

(Stage Development Timespan)



Source: USDA Handbook #283 "Field and Seed Crops Usual Planting and Harvesting Dates", published and and unpublished SRS and state agricultural statistics.

LABELING LOGIC FOR SSG3B AND SSG3C

- SERIES OF FILTERS BASED ON FEATURES OF GREEN NUMBER AND BRIGHTNESS PROFILE

- THE FILTERS CONSIST OF CHECKS FOR MAXIMUM VEGETATION INDICATION AT MID-SEASON, RATE OF DESCENT, VEGETATION INDICATION THROUGH THE SEASON, ETC.

COLOR DEFINITIONS OF SPECTRAL APPEARANCE (SA) STAGES

HUE	FALSE COLOR MNEMONIC	NORMALIZED CHANNEL RANKINGS	HUE	FALSE COLOR MNEMONIC	NORMALIZED CHANNEL RANKINGS
☐	GREEN	2 > 1 > 4	☐	RED	4 > 1 > 2
☐	BLUE	1 > 2 > 4	☐	ORANGE	4 > 2 > 1
☐	PURPLE	1 > 4 > 2	☐	YELLOW	2 > 4 > 1

- VEGETATED - 50% OR MORE OF PIXELS IN A FIELD ARE PURPLE/RED/ORANGE
- NON-VEGETATED - 50% OR MORE OF PIXELS IN A FIELD ARE GREEN/BLUE/YELLOW

SPECTRAL APPEARANCE

1 - NON-VEGETATED WITH ALL PREVIOUS ACQUISITIONS NON-VEGETATED

2 - VEGETATION - NOT TURNED (NOT SATISFYING STAGE 3 CRITERIA)

3 - TURNED VEGETATION WITH MORE THAN 40% OF FIELD PIXELS ORANGE/YELLOW OR SUM OF PURPLE/ORANGE MORE THAN 40% OF SUM OF RED/PURPLE/ORANGE

4 - NON-VEGETATED WITH A PREVIOUS VEGETATED ACQUISITION

9/28/81

PROPORTION ESTIMATION

- SSG3B,3C

  SYSTEMATIC SAMPLE OF 836 DOTS

  RELATIVE COUNT ESTIMATION

- SSG4

  ENUMERATE ALL PIXELS WITHIN SMALL GRAINS LABELED FIELDS

  AN EMPIRICALLY-DERIVED ADJUSTMENT IS APPLIED TO CORRECT FOR OMISSION OF SPRING SMALL GRAINS DUE TO THE LATENESS OF THE FIRST ACQUISITION USED

PROPORTION ESTIMATION EFFICIENCY

D. T. REGISTER
9/28/81

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	SEGS.	YEAR(S)	DATE	TEST PERIOD	
									FROM	TO
11	PILOT	SSG3B CAESAR SEMI-AUTOMATIC SSG3C CAESAR AUTOMATIC SSG4 SPATIAL COLOR	AREA ESTIMATION	SUBSYSTEM	US/CANADA	378	76-79	9/28/81	1/81	9/81
COMBINED PROCEDURES EFFICIENCY REPORT										

BACKGROUND

PREVIOUSLY, EFFICIENCY DATA FOR THE AREA ESTIMATION COMPONENT WERE INCOMPLETE AND DID NOT PROVIDE GOOD VISIBILITY TO AFFORDABILITY.

OBJECTIVES

- OBTAIN QUANTITATIVE MEASUREMENTS OF EFFICIENCY IMPROVEMENTS IN AUTOMATIC SPRING SMALL GRAINS TECHNOLOGIES
- DEFINE STANDARD METHODS FOR OBTAINING AND DOCUMENTING MEASUREMENTS OF EFFICIENCY
- OBTAIN EFFICIENCY DATA AT SUBCOMPONENT LEVELS FOR:
  - DATA PREPARATION
  - PROCEDURE EXECUTION
  - ANALYST AND TECHNICIAN
  - COMPUTER, CONNECT, OPERATOR
- PROVIDE VISIBILITY AT SUBCOMPONENT LEVEL OF AREAS WHERE EFFICIENCY CAN BE IMPROVED

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	SEGS.	YEAR(S)	DATE	TEST PERIOD	
									FROM	TO
11	PILOT	SSG3B CAESAR SEMI-AUTOMATIC SSG3C CAESAR AUTOMATIC SSG4 SPATIAL COLOR	AREA ESTIMATION	SUBSYSTEM	US/CANADA	378	76-79	9/28/8	1/81	9/81
COMBINED PROCEDURES EFFICIENCY REPORT										

DESCRIPTION

- ANALYST FUNCTIONS INCLUDE ANALYST INTERPRETER SKILLS.
- TECHNICIAN FUNCTIONS INCLUDE:
  - + TRAINED TECHNICIAN TO RECOGNIZE AND RECORD CLOUD COVER AND REGISTRATION PROBLEMS.
  - + DATA ENTRY, INCLUDING STATUS AND TRACKING.
  - + CLERICAL, INCLUDING DATA HANDLING.

CONCLUSION

- SIGNIFICANT IMPROVEMENT IN ANALYST TIME-LINE EFFICIENCY HAS BEEN ACHIEVED COMPARED TO PRE-AGRISTARS TECHNOLOGY.
- IMPROVEMENT IN TECHNICIAN SUPPORT CANNOT BE DIRECTLY COMPARED TO PRE-AGRISTARS TECHNOLOGY, BUT MOST TECHNICIAN FUNCTIONS CAN BE POTENTIALLY AUTOMATED.

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	SEGS.	YEAR(S)	DATE	TEST PERIOD	
									FROM	TO
11	PILOT	SSG 3B - CAESAR-SEMI AUTO SSG 3C - CAESAR-AUTO SSG 4 - SPATIAL COLOR SEQ	AREA EST.	SUBSYSTEM	US/CAN	378	76-79	9/28	1/81	9/81

COMBINED PROCEDURES EFFICIENCY REPORT

		PRE AgRISTARS	SSG 3B	SSG 3C	SSG 4
	MANUAL				
DATA BASE	• ANALYST	N/A	15'		15'
PREPARATION	• TECHNICIAN		166'		141'
	COMPUTER				
	• CPU	N/A	19.6'		5'
	MANUAL				
PROCEDURE	• ANALYST	240'	50'	0	0
EXECUTION	• TECHNICIAN	N/A	24'	5'	5'
	COMPUTER				
	• CPU	60'	1.4'	.4'	8.1'

N/A = NOT AVAILABLE

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	SEGS.	YEAR(S)	DATE	TEST PERIOD	
									FROM	TO
11	PILOT	SSG2 CLASSY/REFORMATTED SSG3B CAESAR SEMI-AUTO. SSG3C CAESAR AUTOMATIC SSG4 SPATIAL/COLOR	AREA ESTIMATION	SYSTEM	US/CANADA NORTHERN GREAT PLAINS	378	5/SEG	9/28	1/81	9/81

PROCEDURES EFFICIENCY

	MANUAL		COMPUTER			TURNAROUND
	ANALYST	TECHNICIAN	CPU	OPERATOR	CONNECT	TIMES
SSG2	360.0	269	67.2	134.6	188.9	12
SSG3B	65'	190	21'	44'	98'	8
SSG3C	15'	171	20'	40.8'	79.8'	6
SSG4	15'	145	13.2'	8'	32.6'	5

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	SEGS.	YEAR(S)	DATE	TEST PERIOD	
									FROM	TO
11	PILOT	SSG2 CLASSY/REFORMATED SSG3B CAESAR SEMI.-AUTO. SSG3C CAESAR AUTO. SSG4 SPATIAL/COLOR	AREA ESTIMATION	SYSTEM	US/CANADA NORTHERN GREAT PLAINS	378	5/SEG	9/28/81	1/81	9/81

PROCEDURES EFFICIENCY

IMAGE QUALITY DATA BASE

	TECHNICIAN	CLERICAL
PACKET PREPARATION		
o SORT/FILE IMAGERY	20'	
o CUT, MOUNT, SCRIBE	35'	
CLOUD SCREEN		
o SCREEN FOR CLOUDS & DATA DROPOUT/RECORD	35'	
o LOCATE/RECORD REFERENCE SCENE	10'	
o TRANSMIT REFERENCE SCENE TO CARTO	10'	
REGISTRATION		
o REGISTRATION CHECK BY CARTO	15'	
CLERICAL		
o XEROX CLOUD COVER FORMS SUBMIT ORIGINAL TO KEYPUNCH REFILE PACKET		15'
INPUT ON IMAGE QUALITY DATA BASE		
o INPUT IMAGE QUALITY DATA		5'
o VERIFY INPUTS		
	125'	20'

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	DATA SET		DATE	TEST PERIOD	
						SEGS.	ACQS.		FROM	TO
11	PILOT	SSG 3B CAESAR SEMI-AUTOMATIC	AREA ESTIMATION	SYSTEM	US/CANADA NORTHERN GREAT PLAINS	378	5/SEG	9/28/81	6/24	8/10

PROCEDURES EFFICIENCY DATA

GROUP	FUNCTION		ANALYST		TECHNICIAN/CLERICAL				COMPUTER OPS.				TURN-AROUND TIME (DAYS)
									BATCH		INTERACTIVE		
	NO.	NAME	CONTACT	CLER.	QA	DATA HANDLING, STATUS, TRACKING	CLERICAL	TECHNICIAN	CPU	CONNECT	CPU	OPR.	
			MIN	MIN	MIN	MIN	MIN	MIN	MIN: SEC	MIN:SEC	MIN: SEC	MIN: SEC	
DATA PREPARATION FOR ANALYSIS	1	SOIL LINE	-	-	5'	1.5'	-	-	2.5'	15'	.0005'	5'	1
	1,2	MERGE & TRANSFORM	-	-	10'	6'	-	-	12'	60'	.0003'	12'	1
	-	DIRECTORY	-	-	1'	1.25'	-	-	.0004'	.06'	.0004'	15.25'	1
	3.4	IMAGE QUALITY DATA BASE	14'	1'	-	-	15'	125'	.0002'	.03'	.0002'	5'	3
CROP CALENDAR PREPARATION	5	MET DATA BASE	-	-	-	-	-	-	-	-	5.0'	1'	-
	6	BIOWINDOW MIDPOINT	—	—	—	—	—	—	—	—	0.07'	-	1
	7	BIOWINDOW MODEL	-	-	-	-	-	0.83'	-	-	-	-	-
LABELING AND PROPORTION ESTIMATION	8, 9	AUTO. ACQUISITION SELECTION GREEN NO. GENERA.	-	-	2'	3'	-	-	.68'	9.32'	.0003'	2.5'	1
	10	ACQ. VERIFICATION	35'	15'	5'	7'	-	2'	-	-	-	-	1
	11 12	AUTOMATIC PIXEL LABELING	-	-	2'	3'	-	-	.71'	13.37'	.0233'	3.4'	1
	13, 14,	PROPORTION ESTIMA. (TRANSFER TO AA)											
		TOTAL	49'	16'	25'	21.8'	15'	128'	15.89'	97.78'	5.095'	44.15'	8

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	DATA SET		DATE	TEST PERIOD	
						SEGS.	ACQS.		FROM	TO
11	PILOT	SSG 3C CAESAR AUTOMATIC	AREA ESTIMATION	SYSTEM	US/CANADA NORTHERN GREAT PLAINS	378	5/SEG	9/28/81	6/24	8/10

PROCEDURES EFFICIENCY DATA

GROUP	FUNCTION		ANALYST		TECHNICIAN/CLERICAL				COMPUTER OPS.				TURN-AROUND TIME (DAYS)	
									BATCH		INTERACTIVE			
	NO.	NAME	CONTACT	CLER.	QA	DATA HANDLING, STATUS, TRACKING	CLERICAL	TECHNICIAN	CPU	CONNECT	CPU	OPR.		
			MIN	MIN	MIN	MIN	MIN	MIN	MIN: SEC	MIN:SEC	MIN: SEC	MIN: SEC		
DATA PREPARATION FOR ANALYSIS	1	SOIL LINE	-	-	5'	1.5'	-	-	2.5'	15'	.0005'	5.25'	1	4
	1,2	MERGE & TRANSFORM	-	-	10'	6.0'	-	-	12'	60'	.0003'	12'	1	
	-	DIRECTORY	-	-	1'	1.25'	-	-	.0004'	.06'	.0004'	15'	1	
	3.4	IMAGE QUALITY DATA BASE	14'	1'	-	-	15'	125'	.0002'	.03'	.0002'	5'	3	
CROP CALENDAR PREPARATION	5	MET DATA BASE	-	-	-	-	-	-	-	-	5.0'	1'	-	
	6	BIOWINDOW MIDPOINT MODEL	-	-	-	-	-	0.83'	-	-	-	-	-	
	7	BIOWINDOW MIDPOINT DATA BASE	-	-	-	-	-	-	-	-	.07'	-	1	
LABELING AND PROPORTION ESTIMATION	8, 9, 10,	AUTOMATIC ACQ. SELECTION GREEN # GENERATION AUTOMATIC LABELING	-	-	2'	3'	-	-	.43'	4.73'	.0003'	2.5'	1	
	11, 12	PROPORTION ESTIMATES, (TRANSFER TO AA)												
		TOTAL	14'	1'	18'	12'	15'	126'	14.93'	79.82'	5.07'	40.75'	6	

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	DATA SET		DATE	TEST PERIOD	
						SEGS.	ACQS.		FROM	TO
11	PILOT	SSG4 SPATIAL COLOR SEQUENCE PROPORTION ESTIMATION TECHNIQUE	AREA ESTIMATION	SYSTEM	US/CANADA NORTHERN GREAT PLAINS	378	5/SEG	9/28/81	6/8	7/31

PROCEDURES EFFICIENCY DATA

GROUP	FUNCTION		ANALYST		TECHNICIAN/CLERICAL				COMPUTER OPS.				TURN-AROUND TIME (DAYS)
									BATCH		INTERACTIVE		
	NO.	NAME	CONTACT	CLER.	QA	DATA HANDLING, STATUS, TRACKING	CLERICAL	TECHNICIAN	CPU	CONNECT	CPU	OPR.	
			MIN	MIN	MIN	MIN	MIN	MIN	MIN: SEC	MIN:SEC	MIN: SEC	MIN: SEC	
DATA PREP. FOR ANALYSIS	1,2	IMAGE QUALITY DATA BASE	14'	1'	-	-	15'	125'	.0002'	.03'	.0002'	5'	3
CROP CALENDAR PREPARATION	3	MET DATA BASE	-	-	-	-	-	-	-	-	5'	1'	-
	4	BIOWINDOW DURATION MODEL	-	-	-	-	-	0.83'	-	-	-	-	-
	5	BIOWINDOW DATA BAS DATA BASE	-	-	-	-	-	-	-	-	0.07'	-	1
LABELING AND PROPORTION ESTIMATION	6 ↓ 16	EX. FOR CROP CALENDAR ACQ. SELECTION FIELD FIND, AUTO LABEL, PROP. EST.	-	-	2'	2'	-	-	8.1'	32.55'	-	2'	1
		TOTAL	14'	1'	2'	2'	15'	126'	8.1'	32.58'	5.07'	8'	5

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	DATA SET		DATE	TEST PERIOD	
						SEGS.	ACQS.		FROM	TO
11	PILOT	SSG 2 "CLASSY"/REFORMATTED (2A)	AREA ESTIMATION	SYSTEM	US/CANADA NORTHERN GREAT PLAINS	378 (30)	5/SEG	9/28/81	1/15	9/1/81

PROCEDURES EFFICIENCY DATA

GROUP	FUNCTION		ANALYST		TECHNICIAN/CLERICAL				COMPUTER OPS.				TURN-AROUND TIME (DAYS)
									BATCH		INTERACTIVE		
	NO.	NAME	CONTACT	CLER.	QA	DATA HANDLING, STATUS, TRACKING	CLERICAL	TECHNICIAN	CPU	CONNECT	CPU	OPR.	
			MIN	MIN	MIN	MIN	MIN	MIN	MIN: SEC	MIN:SEC	MIN: SEC	MIN: SEC	
DATA PREPARATION FOR ANALYSIS	1	SOIL LINE	-	-	5'	1.5'	-	-	2.5'	15'	.0005'	5'	1
	1,2	MERGE & TRANSFORM	-	-	10'	6.0'	-	-	12'	60'	.0003'	12'	1
	-	DIRECTORY	-	-	1'	1.25'	-	-	.0004'	.06'	.0004'	15.25'	1
	3,4	IMAGE QUALITY DATA BASE	14	1	-	-	15'	125'	.0002'	.03'	.0002'	5'	3
													4
CROP CALENDAR PREPARATION	5	MET DATA BASE	-	-	-	-	-	-	-	-	5.0'	1'	
	6	BIOWINDOW MIDPOINT	-	-	-	-	-	-	-	-	0.07'	-	1
	7	BIOWINDOW MODEL	-	-	-	-	-	0.83'	-	-	-	-	-
		TOTAL	14'	1'	16'	9'	15'	126'	14.5'	75.1'	5.1'	38.25'	5

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	DATA SET		DATE	TEST PERIOD	
						SEGS.	ACQS.		FROM	TO
11	PILOT	SSG2 "CLASSY"/REFORMATTED (2A)	AREA ESTIMATION	SYSTEM	US/CANADA NORTHERN GREAT PLAINS	378 (30)	5/SEG	9/28/81	1/15	9/1

PROCEDURES EFFICIENCY DATA

GROUP	FUNCTION		ANALYST		TECHNICIAN/CLERICAL				COMPUTER OPS.				TURN-AROUND TIME (DAYS)
									BATCH		INTERACTIVE		
	NO.	NAME	CONTACT	CLER.	QA	DATA HANDLING, STATUS, TRACKING	CLERICAL	TECHNICIAN	CPU	CONNECT	CPU	OPR.	
			MIN	MIN	MIN	MIN	MIN	MIN	MIN: SEC	MIN:SEC	MIN: SEC	MIN: SEC	
ACQUISITION SELECTION	8	ACQ. SELECTION PROGRAM	-	-	4'	4'	5'	-	.40'	9.00	.0003	2.5'	1
	9	GENERATE GREEN #	-	-	3'	4'	-	-	.48'	8.54'	.28'	0.5'	1 } 1
	10	MANUAL SCREENING (ACQ. VERIFICATION	38.9'	10'	10'	7'	2'	-	-	-	-	-	1 }
LABELING	11	CLASSY	-	-	2'	4'	5'	-	43'	78.3'	.0040'	40'	1
	12, 13, 14,	BAYESIAN PROP. ALLOC. OF PIXELS TO CLUSTERS CANDIDATE PIXELS TO BE LABELED											
	15, 16,	ANALYST PIXEL SCREEN (PURE PIXEL ALLOCATION)	206.2'	4'	-	6'	1'	-	-	-	-	-	1
	17, 18, 19,	AUTOMATED PIXEL LABELING SPECTRAL AID GENERATION	-	-	2'	5'	3'	-	2.99'	15.06'	.0040'	30'	1
		TOTAL	245.1'	14'	21'	30'	16'	0'	46.9'	110.9'	0.3'	73'	5

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	DATA SET		DATE	TEST PERIOD	
						SEGS.	ACQS.		FROM	TO
11	PILOT	SSG2 "CLASSY"/REFORMATTED (2A)	AREA ESTIMATION	SYSTEM	US/CANADA NORTHERN GREAT PLAINS	378 (30)	5/SEG	9/28/82	1/15	9/1

PROCEDURES EFFICIENCY DATA

GROUP	FUNCTION		ANALYST		TECHNICIAN/CLERICAL				COMPUTER OPS.				TURN-AROUND TIME (DAYS)
									BATCH		INTERACTIVE		
	NO.	NAME	CONTACT	CLER.	QA	DATA HANDLING, STATUS, TRACKING	CLERICAL	TECHNICIAN	CPU	CONNECT	CPU	OPR.	
			MIN	MIN	MIN	MIN	MIN	MIN	MIN: SEC	MIN:SEC	MIN: SEC	MIN: SEC	
LABELING	20	ANALYST NON-CROPLAND CONFUSION SCREENING (PASTURE FILTER)	76.1'	10'	20'	4'	2'	-	-	- -	-	-	1
	21	MODIFIED LABELED PIXELS UPDATE	-	-	-	-	5'	-	-	-	.0040'	20'	1
PROPORTION ESTIMATION	22 23	PROPORTION ESTIMATION	-	-	-	-	5'	-	.35'	2.9'	.0003'	3.33'	1
		TOTAL	76.1'	10'	20'	4'	12'	0'	0.4'	2.9'	0'	23.3'	2

PROPORTION ESTIMATION ACCURACIES FOR THREE AUTOMATED PROCEDURES

C. V. NAZARE
9/28/81

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	SEGS.	YEAR(S)	DATE	TEST PERIOD	
									FROM	TO
6	PILOT	SSG3B SEMIAUTOMATIC CAESAR SSG3C AUTOMATIC CAESAR SSG4 SPATIAL/COLOR SEQUENCE	AREA ESTIMATION	SUBSYSTEM	US/CANADA MINNESOTA MT ND SD SK	189	76-7?	9/28	8/81	9/81

TEST TITLE: U.S./CANADA SPRING SMALL GRAINS PROPORTION ESTIMATION ACCURACY

GENERAL OBJECTIVE:

TO EVALUATE THE NEAR-HARVEST PROPORTION ESTIMATION ACCURACY AT THE SEGMENT LEVEL OF THREE AUTOMATIC SSG PROCEDURES.

SPECIFIC OBJECTIVES:

TO DETERMINE IF PROCEDURES ARE:

- COMPARABLE TO PREVIOUS STATE-OF-THE ART TECHNOLOGY
- SENSITIVE TO REGIONAL EFFECTS
- SENSITIVE TO YEAR-TO-YEAR EFFECTS

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	SEGS.	YEAR(S)	DATE	TEST PERIOD	
									FROM	TO
6	PILOT	SSG3B - SEMIAUTOMATIC CAESAR SSG3C - AUTOMATIC CAESAR SSG4 - SPATIAL/COLOR SEQUENCE	AREA ESTIMATION	SUBSYSTEM	US/CANADA MINNESOTA MT ND SD SK	189	76-79	9/28	8/81	9/81

DATA SET DISCUSSION

DEFINITION OF SPRING SMALL GRAINS:

- SSG = SPRING WHEAT + DURUM WHEAT + BARLEY + OATS

DATA SET FOR EVALUATION:

- TARGET WAS 300 SEGMENT-YEARS (CANDIDATE GROUND TRUTH SEGMENTS)
- UNABLE TO OBTAIN G.T. FOR 52 SEGMENT-YEARS BECAUSE OF PROBLEMS WITH AIRCRAFT AND/OR FIELD DATA.
- G.T. PROPORTIONS OBTAINED FOR 248 SEGMENT-YEARS
- NO PROCEDURE ESTIMATES FOR 59 SEGMENTS BECAUSE OF ACQUISITION HISTORY, ETC.
- NUMBER OF SEGMENT-YEARS FOR WHICH AT LEAST ONE PROCEDURE GAVE AN ESTIMATE IS 189
- ALL 189 SEGMENT-YEARS WERE USED IN THE PERFORMANCE EVALUATION.

GROUND TRUTH SOURCES:

- UNIVERSAL GROUND TRUTH TAPES (124/189)
  - WALL-TO-WALL PROPORTIONS
- A. A. REPORTS (65/189)
  - SAMPLED PROPORTIONS (DOT COUNTS, PLANIMETER)

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	SEGS.	YEAR(S)	DATE	TEST PERIOD	
									FROM	TO
6	PILOT	SSG3B - SEMIAUTOMATIC CAESAR SSG3C - AUTOMATIC CAESAR SSG4 - SPATIAL/COLOR SEQUENCE	AREA ESTIMATION	SUBSYSTEM	U.S./CANADA MN, ND, MT, SK, SD	189	1976-79	9/28/81	8/81	10/81

STANDARD STATISTICS/METHODOLOGY

- MEAN ERROR: $\bar{e} = \sum_{i=1}^{n} (\hat{P}_i - P_i)/n = \frac{1}{n} \sum_{i=1}^{n} e_i$

- STANDARD DEVIATION OF ERRORS: $S_e = \left[\sum_{i=1}^{n} (e_i - \bar{e})^2/n - 1\right]^{1/2}$

- MEAN ABSOLUTE ERROR: $MAE = \sum_{i=1}^{n} |e_i|/n$

- MEAN GROUND TRUTH: $\bar{p} = \sum_{i=1}^{n} P_i/n$

- RELATIVE MEAN ERROR (%): $RME = \bar{e}/\bar{p} \times 100$

- STATISTICALLY SIGNIFICANT RESULTS: THOSE WHICH WOULD OCCUR BY CHANCE LESS THAN 10 PERCENT OF THE TIME IF NO BIAS WERE PRODUCED BY THE PROCEDURE.

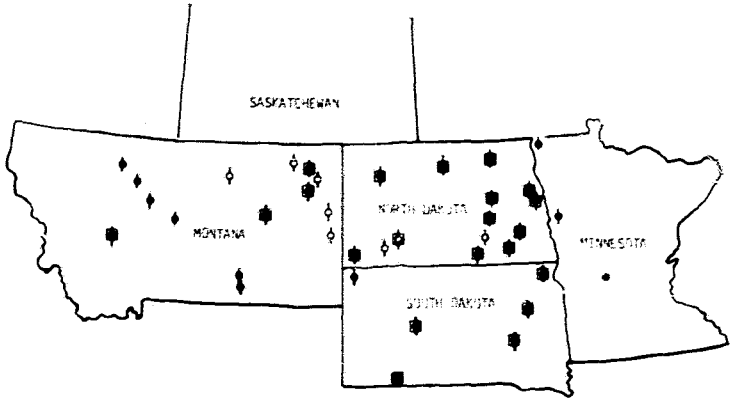
$\hat{P}_i$ = PROPORTION ESTIMATE FOR i^{th} OBSERVATION (%)

P_i = GROUND TRUTH PROPORTION FOR i^{th} OBSERVATION (%)

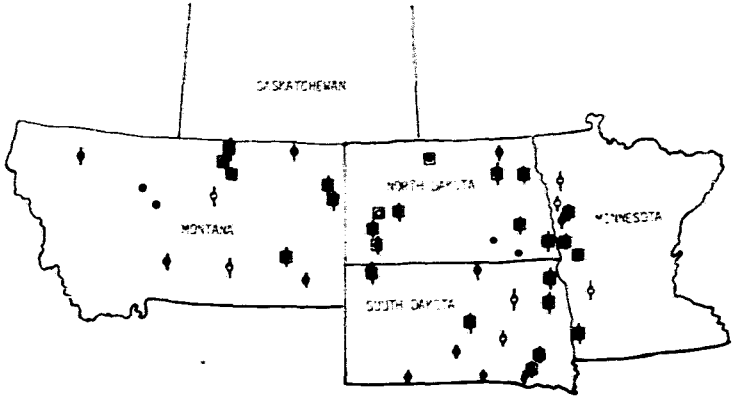
e_i = PROPORTION ERROR FOR i^{th} OBSERVATION = $\hat{P}_i - P_i$

n = NUMBER OF OBSERVATIONS

1976



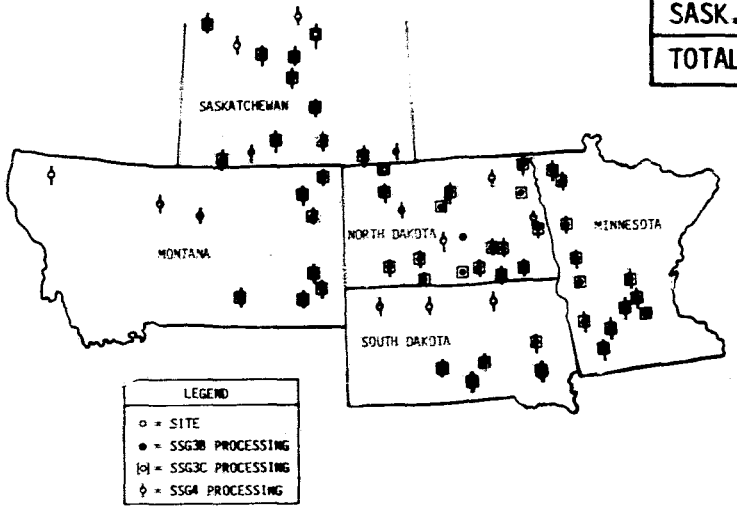
1977



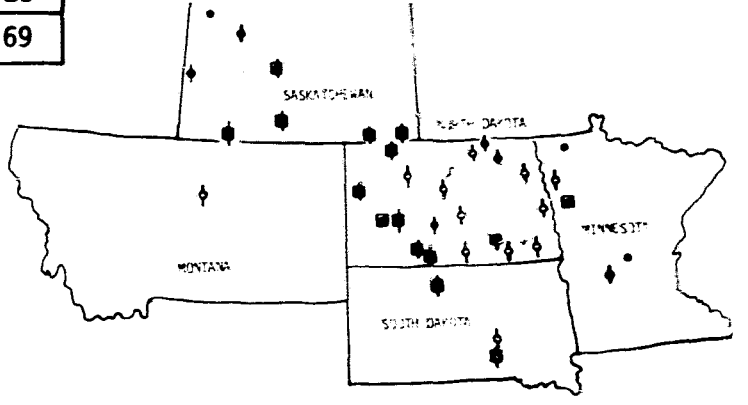
TOTAL SEGMENTS PROCESSED 1976-79

STATE	SSG3B	SSG3C	SSG4
MN	24	17	22
MT	30	17	36
ND	51	45	61
SD	21	18	29
SASK.	18	15	21
TOTAL	144	112	169

1978



1979



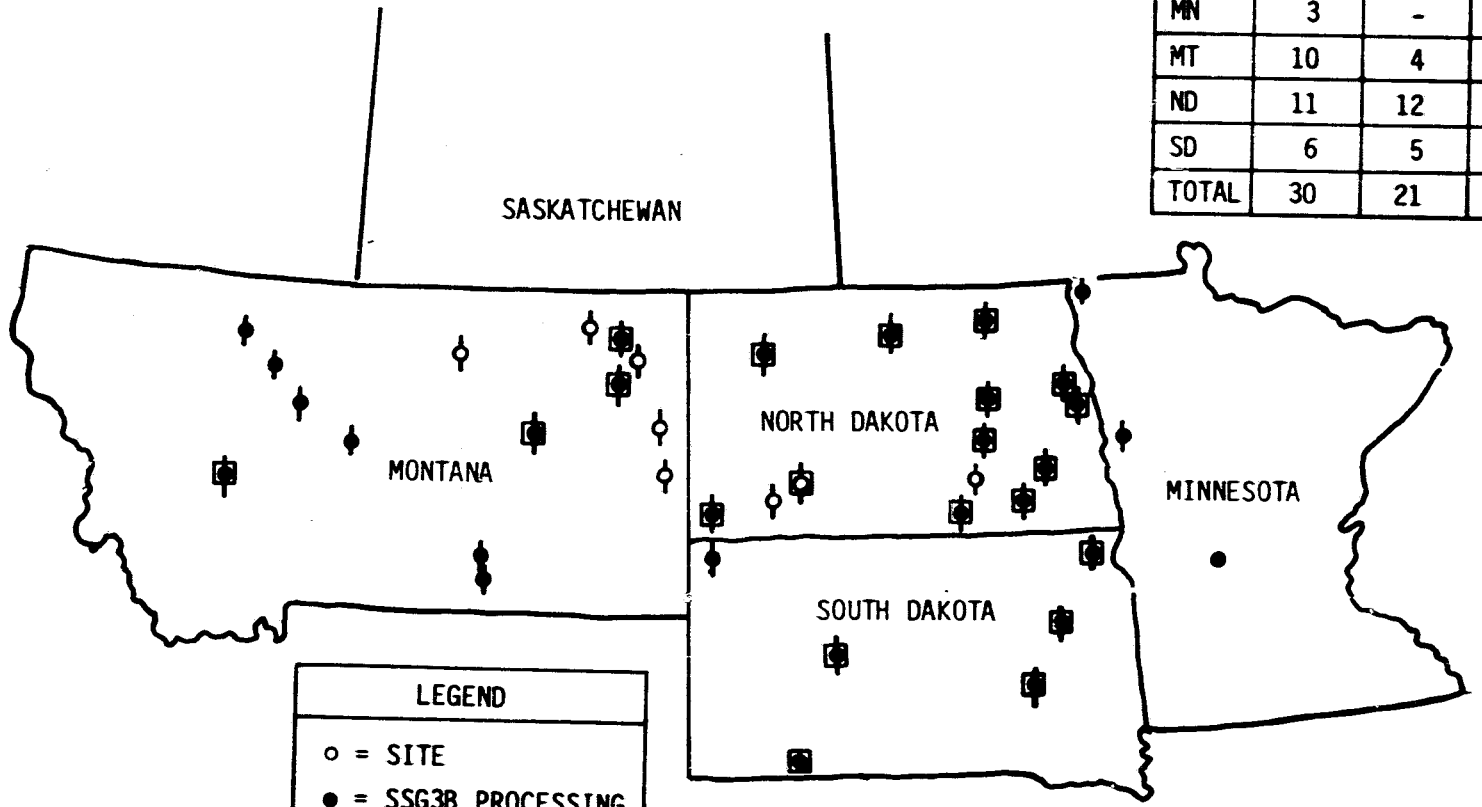
9/28/81

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	SEGS.	YEAR(S)	DATE	TEST PERIOD	
									FROM	TO
6	PILOT	SSG3B CAESAR SEMIAUTOMATIC SSG3C CAESAR AUTOMATIC SSG4 SPATIAL/COLOR SEQUENCE	AREA ESTIMATION	SUBSYSTEM	U.S./CANADA NGP	189	1976-79	9/28/81	8/81	9/81

LOCATION OF 1976 SEGMENT PROPORTION ESTIMATES/ERROR ANALYSIS OF THREE PROCEDURES

NUMBER OF SEGMENTS PROCESSED

STATE	SSG3B	SSG3C	SSG4
MN	3	-	2
MT	10	4	15
ND	11	12	14
SD	6	5	5
TOTAL	30	21	36



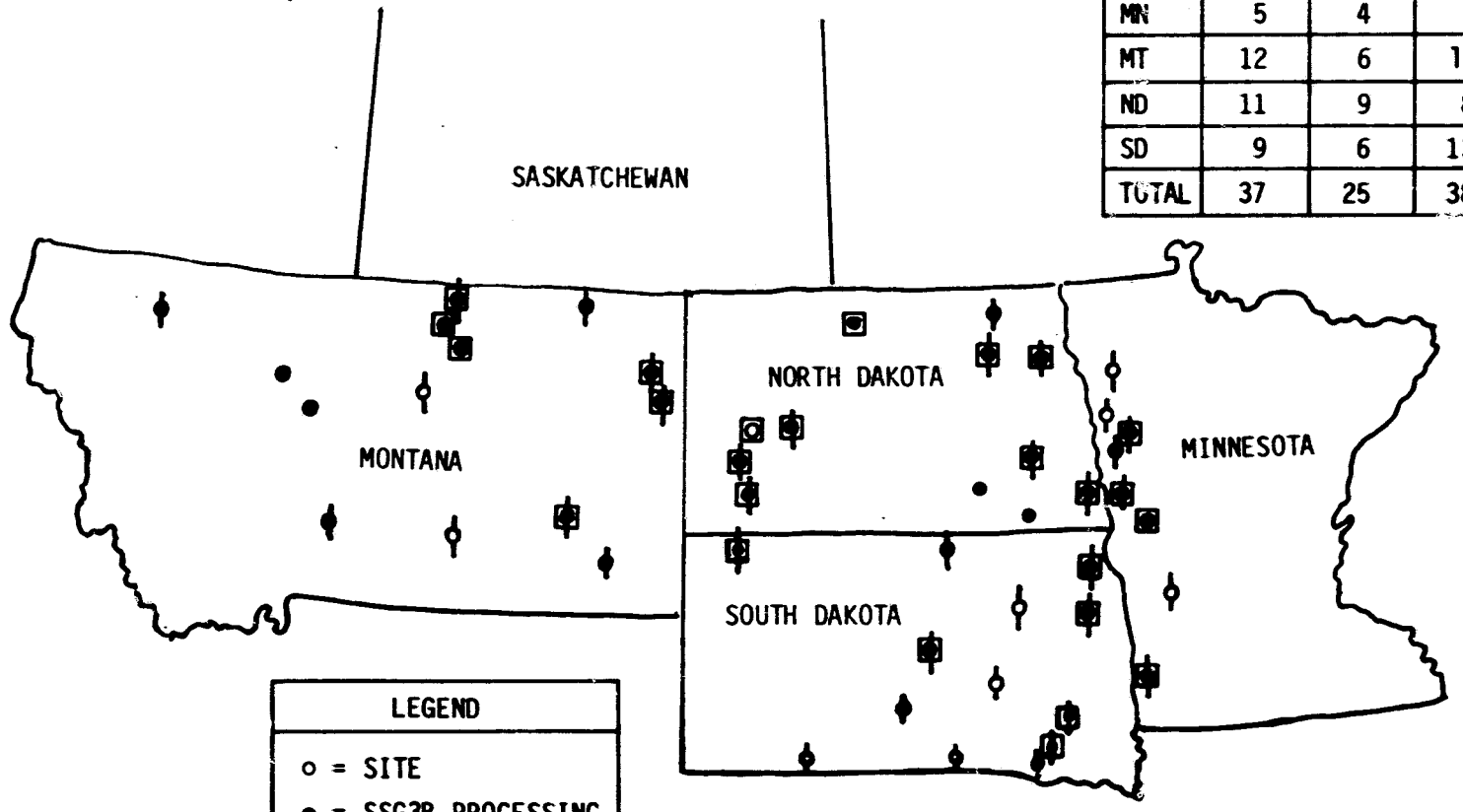
9/28/81

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	SEGS.	YEAR(S)	DATE	TEST PERIOD	
									FROM	TO
6	PILOT	SSG3B CAESAR SEMIAUTOMATIC SSG3C CAESAR AUTOMATIC SSG4 SPATIAL/COLOR SEQUENCE	AREA ESTIMATION	SUBSYSTEM	U.S./CANADA NGP	189	1976-79	9/28/81	8/81	9/81

LOCATION OF 1977 SEGMENT PROPORTION ESTIMATES/ERROR ANALYSIS OF THREE PROCEDURES

NUMBER OF SEGMENTS PROCESSED

STATE	SSG3B	SSG3C	SSG4
MN	5	4	7
MT	12	6	10
ND	11	9	8
SD	9	6	13
TOTAL	37	25	38



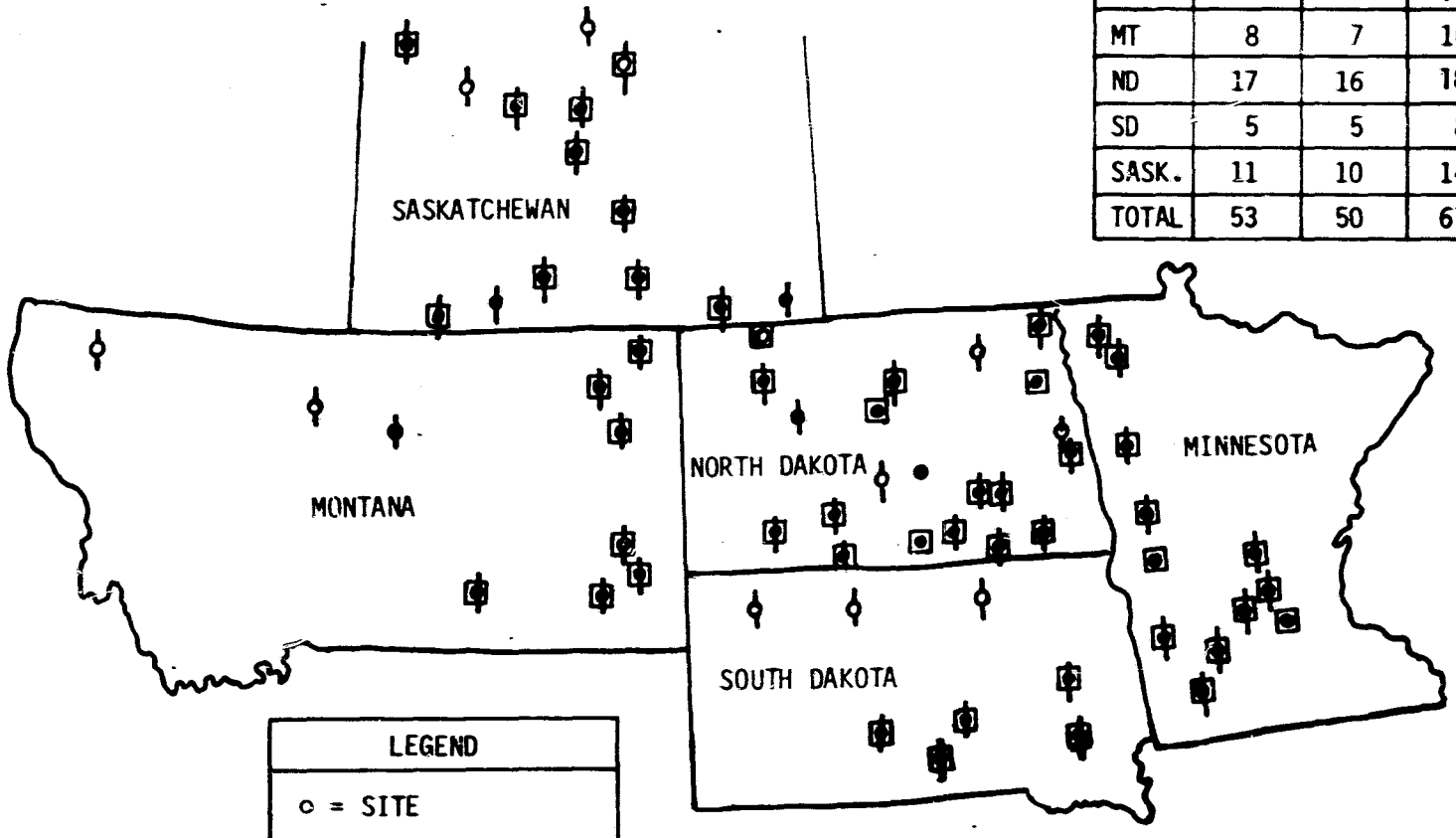
9/28/81

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	SEGS.	YEAR(S)	DATE	TEST PERIOD	
									FROM	TO
6	PILOT	SSG3B CAESAR SEMIAUTOMATIC SSG3C CAESAR AUTOMATIC SSG4 SPATIAL/COLOR SEQUENCE	AREA ESTIMATION	SUBSYSTEM	U.S./CANADA NGP	189	1976-79	9/28/81	8/81	9/81

LOCATION OF 1978 SEGMENT PROPORTION ESTIMATES/ERROR ANALYSIS OF THREE PROCEDURES

NUMBER OF SEGMENTS PROCESSED

STATE	SSG3B	SSG3C	SSG4
MN	12	12	11
MT	8	7	10
ND	17	16	18
SD	5	5	8
SASK.	11	10	14
TOTAL	53	50	61



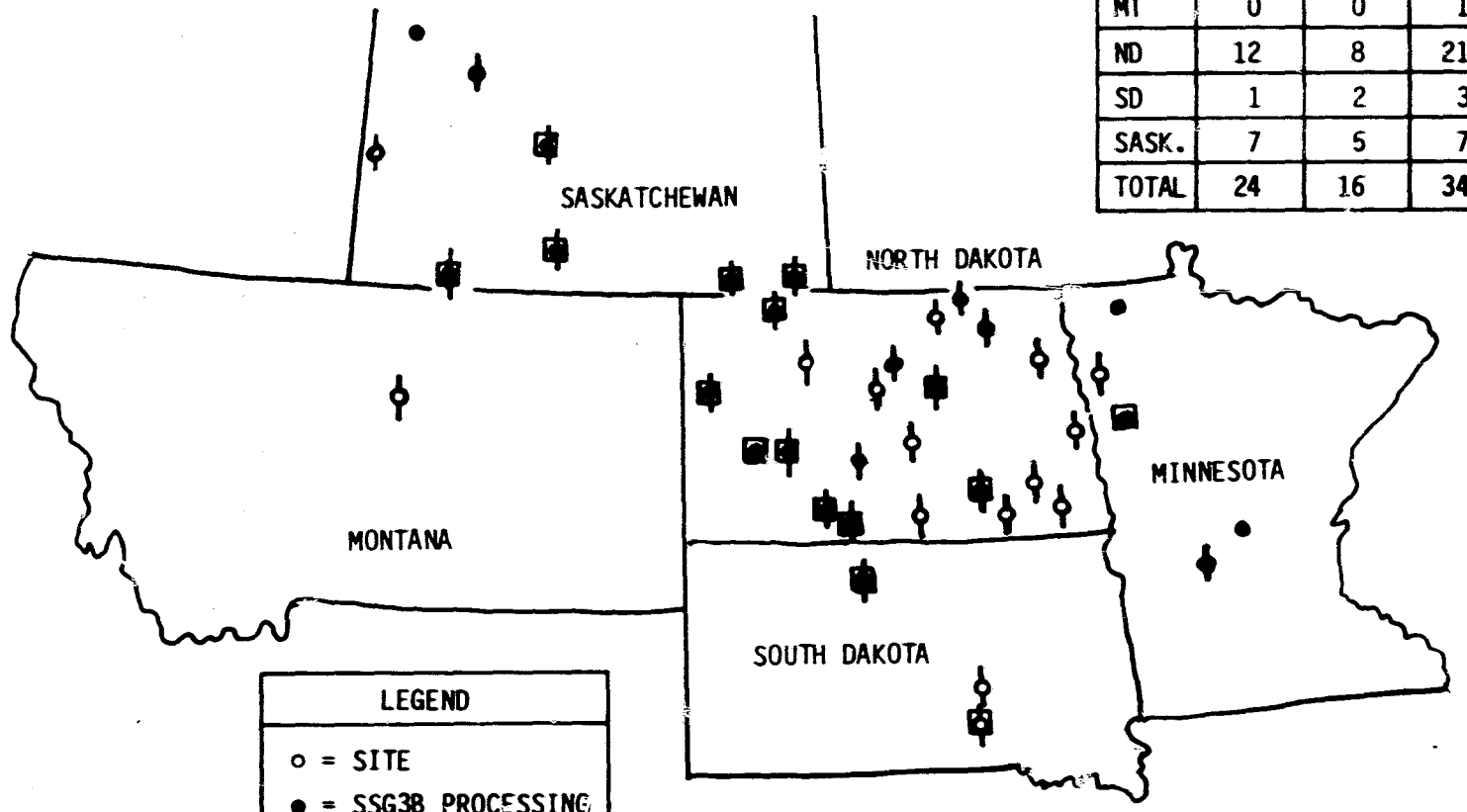
9/28/81

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	SEGS.	YEAR(S)	DATE	TEST PERIOD	
									FROM	TO
6	PILOT	SSG3B CAESAR SEMIAUTOMATIC SSG3C CAESAR AUTOMATIC SSG4 SPATIAL/COLOR SEQUENCE	AREA ESTIMATION	SUBSYSTEM	U.S./CANADA NGP	189	1976-79	9/28/81	8/81	9/81

LOCATION OF 1979 SEGMENT PROPORTION ESTIMATES/ERROR ANALYSIS OF THREE PROCEDURES

NUMBER OF SEGMENTS PROCESSED

STATE	SSG3B	SSG3C	SSG4
MN	4	1	2
MT	0	0	1
ND	12	8	21
SD	1	2	3
SASK.	7	5	7
TOTAL	24	16	34



9/28/81

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	SEGS.	YEAR(S)	DATE	TEST PERIOD	
									FROM	TO
6	PILOT	SSG3B - SEMIAUTOMATIC CAESAR SSG3C - AUTOMATIC CAESAR SSG4 - SPATIAL/COLOR SEQUENCE	AREA ESTIMATION	SUBSYSTEM	US/CANADA MINNESOTA MT ND SD SK	189	76-79	9/28	8/81	9/81

APPROACH

+ EVALUATE EACH PROCEDURE INDEPENDENTLY
  - BY YEAR
  - BY STATE
  - BY REGION
+ COMPARE PROPORTION ESTIMATION ACCURACIES OF PROCEDURES
  - OVER SEGMENTS COMMON TO 2 PROCEDURES BY YEAR

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	SEGS.	YEAR(S)	DATE	TEST PERIOD	
									FROM	TO
6	PILOT	SSG3B - SEMIAUTOMATIC CAESAR SSG3C - AUTOMATIC CAESAR SSG4 - SPATIAL/COLOR SEQUENCE	AREA ESTIMATION	SUBSYSTEM	US/CANADA MINNESOTA MT ND SD SK	189	76-79	9/28	8/81	9/81

TEST RESULTS

- THE PERFORMANCE OF EACH AUTOMATED PROCEDURE IS COMPARABLE TO PREVIOUS MANUAL-INTENSIVE PRE-AGRISTARS PROPORTION ESTIMATION TECHNOLOGIES.
  - WITH A SMALLER BIAS
  - WITH A LARGER VARIANCE
- PROPORTION ESTIMATION PERFORMANCES FROM STATE-TO-STATE WERE HIGHLY VARIABLE.
- PERFORMANCE (BIAS AND VARIANCE) OF THE THREE PROCEDURES WAS APPROXIMATELY THE SAME IN THE USSR FSR AND THE LARGEST APU'S.
- THERE WAS NO SIGNIFICANT DIFFERENCE IN PERFORMANCE (MAE) BETWEEN SSG4 AND SSG3C ON A COMMON DATA SET.
- SSG3B SHOWED A STATISTICALLY SIGNIFICANT IMPROVEMENT IN PERFORMANCE (MAE) OVER SSG3C ON A COMMON DATA SET.

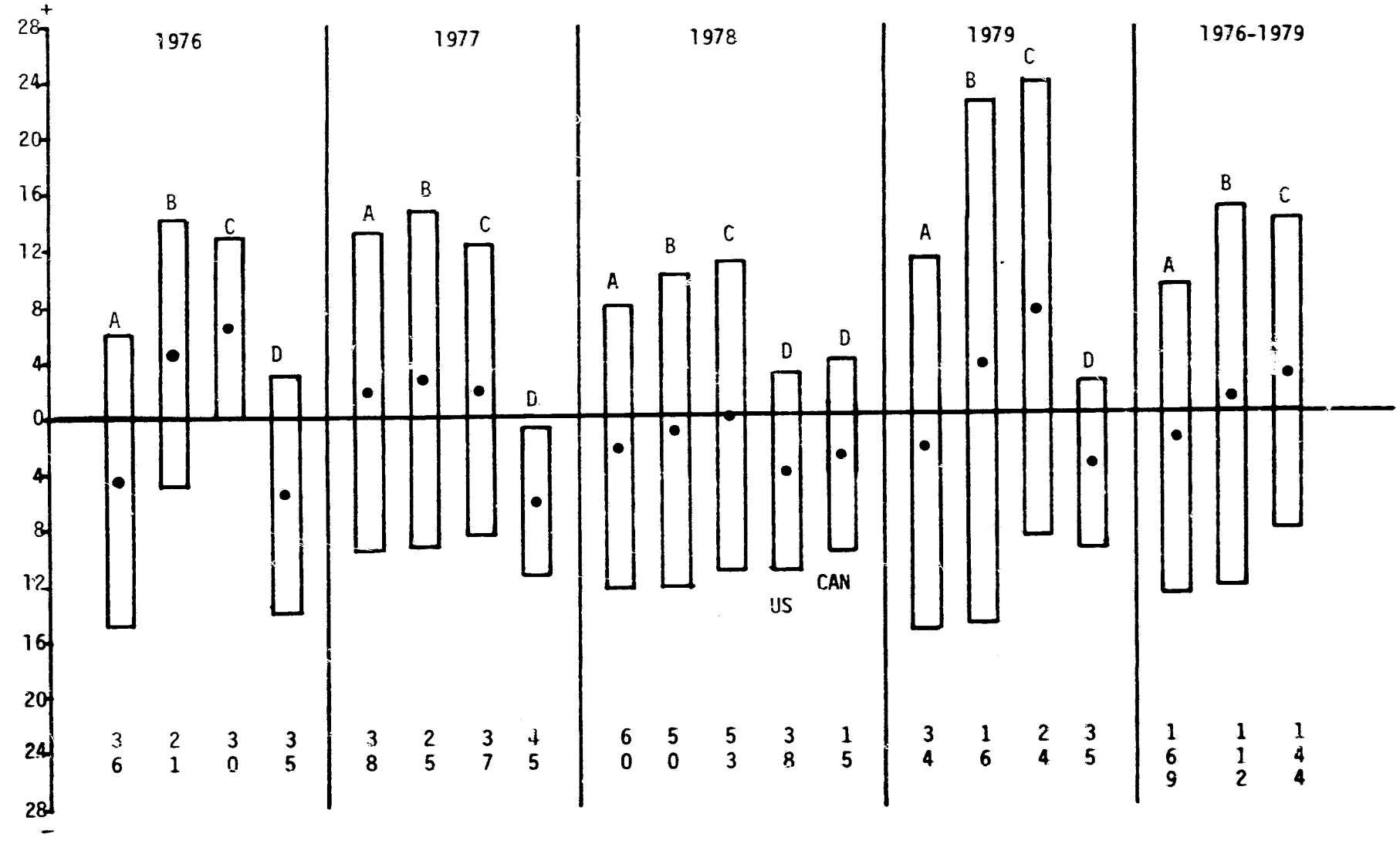
PERFORMANCES OF SSG4, SSG3C and SSG3B BY YEAR

STATISTIC	ALL YEARS			1976			1977			1978			1979		
	SSG4	SSG3C	SSG3B	SSG4	SSG3C	SSG3B	SSG4	SSG3C	SSG3B	SSG4	SSG3C	SSG3B	SSG4	SSG3C	SSG3B
$\bar{e}$	-1.74*	1.55	3.01*	-4.48*	4.56*	5.62*	1.95	2.76	2.12	-2.21	-1.04	0.04	-2.14	3.80	7.71*
S_e	11.51	12.65	11.31	10.68	9.10	6.72	11.65	12.09	9.51	10.34	11.52	11.12	13.53	19.05	16.23
MAE	8.65	9.94	8.49	8.24	7.89	6.16	9.27	9.81	7.73	7.92	9.01	8.44	9.70	15.35	12.66
RME	-6.45	5.72	11.51	-19.45	16.70	24.10	7.62	10.04	8.20	-8.15	-3.90	0.15	-6.61	13.77	25.30
$\bar{p}$	26.96	27.10	26.16	23.03	27.31	23.32	25.59	27.48	25.85	27.11	26.66	26.04	32.38	27.60	30.47
n	169	112	144	36	21	30	38	25	37	60	50	53	34	16	24

	LACIE Phase II	LACIE Phase III	LACIE TY		'80 SSG Exploratory
			US	SK	
$\bar{e}$	-5.51*	-6.10*	-4.0*	-2.9	-3.5*
S_e	8.52	5.40	7.40	7.36	5.9
MAE	-24.51	-17.48	-13.94	-6.8	-11.9
n	35	45	38	15	35

* Indicates that the mean error was significantly different from zero at the 10% level of significance.

PERFORMANCES OF SSG4, SSG3C AND SSG3B BY YEAR



● = Mean Error

[ ] = ±1 Std. Dev. of Error

[A] = SSG4

[B] = SSG3C

[C] = SSG3B

[D] = Historical Procedures

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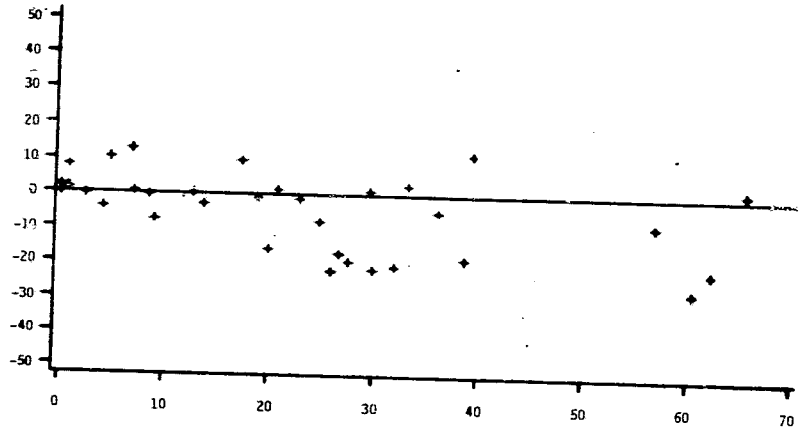
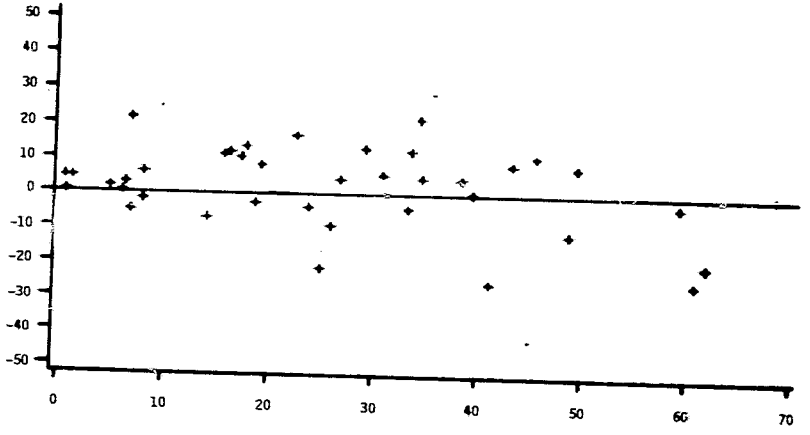
SSG4 PROPORTION ERROR VERSUS GROUND TRUTH PROPORTION

YEAR = 1976



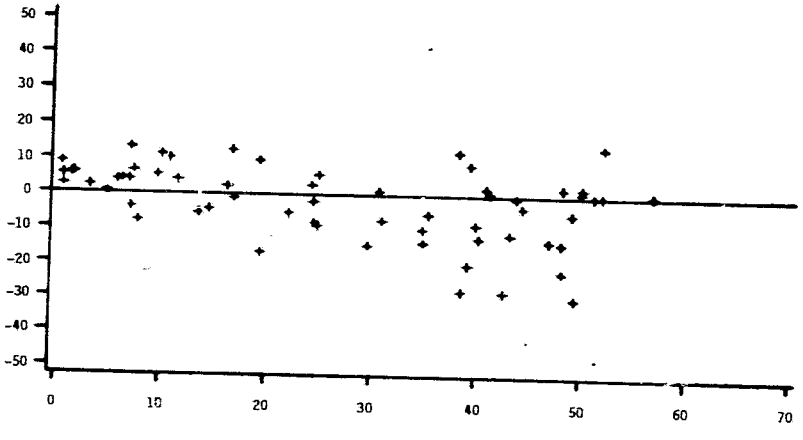
YEAR = 1977



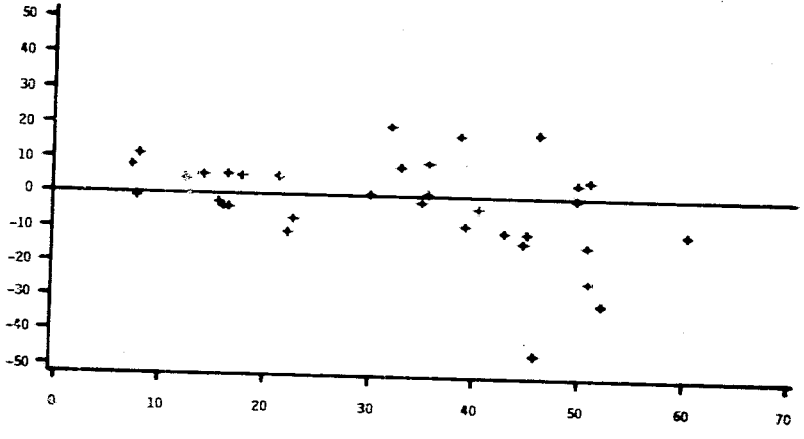
PROPORTION ERROR

GROUND TRUTH PROPORTION

YEAR = 1978

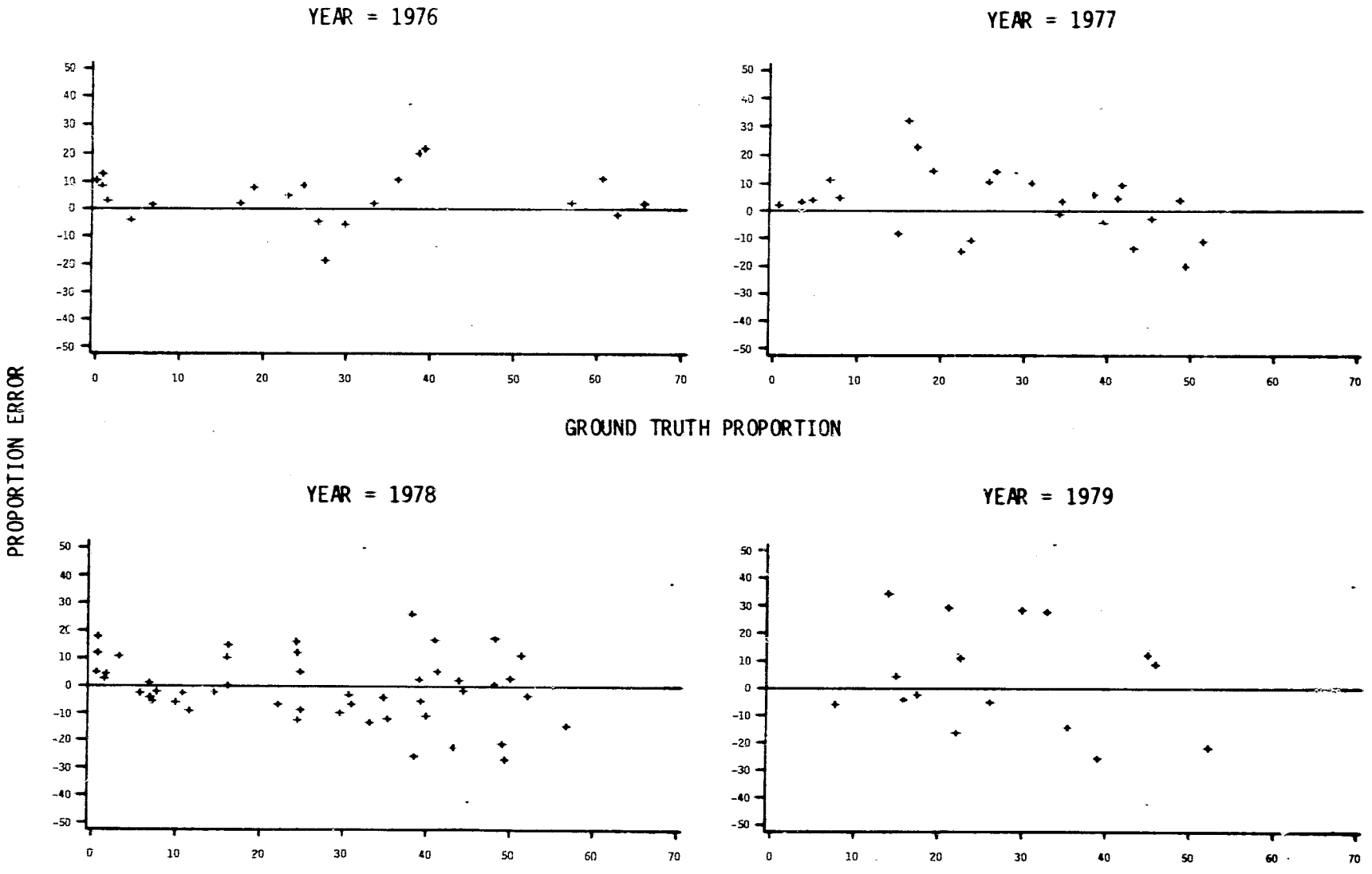


YEAR = 1979



9/28/81

SSG3C PROPORTION ERROR VERSUS GROUND TRUTH PROPORTION



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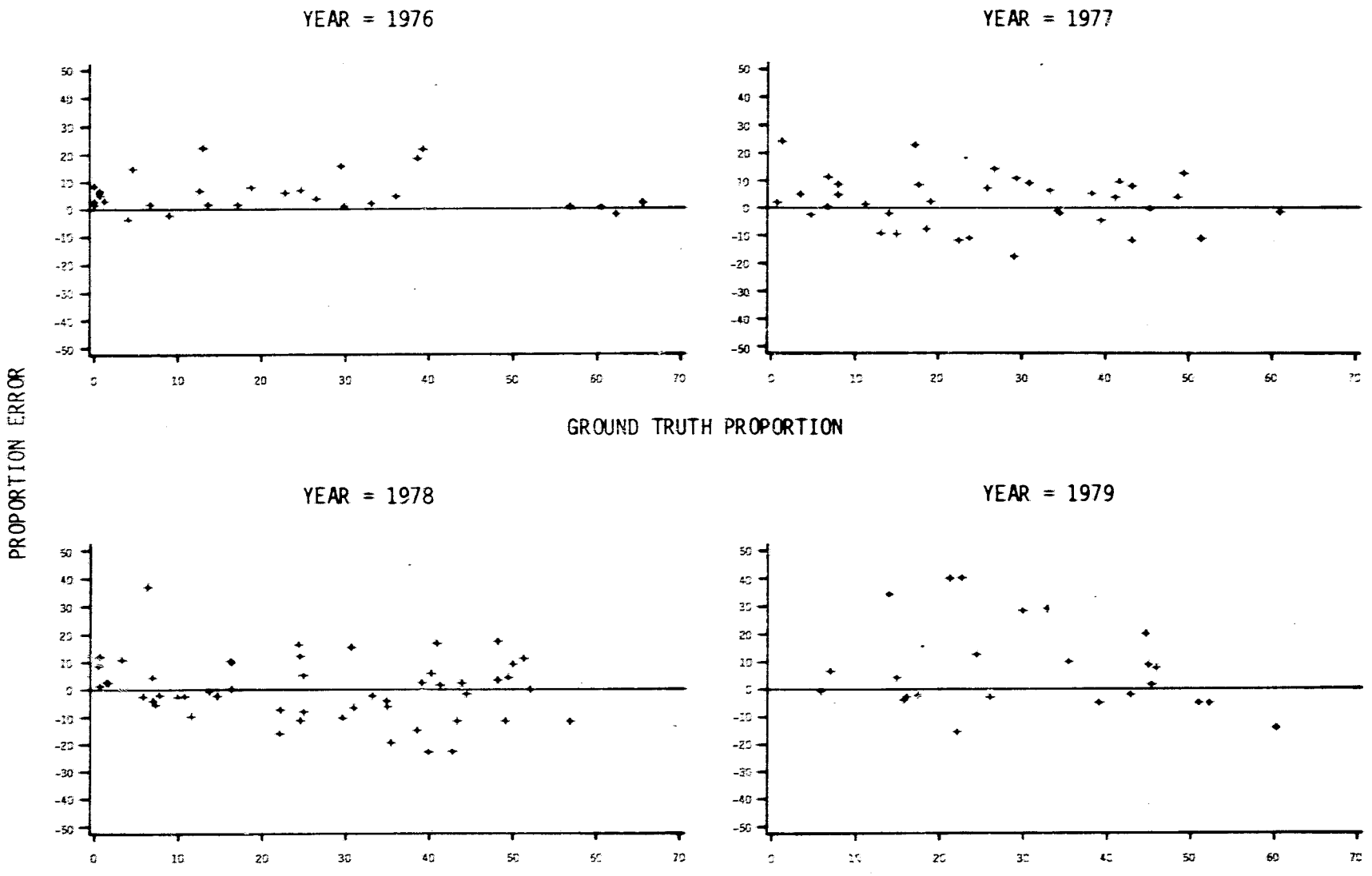
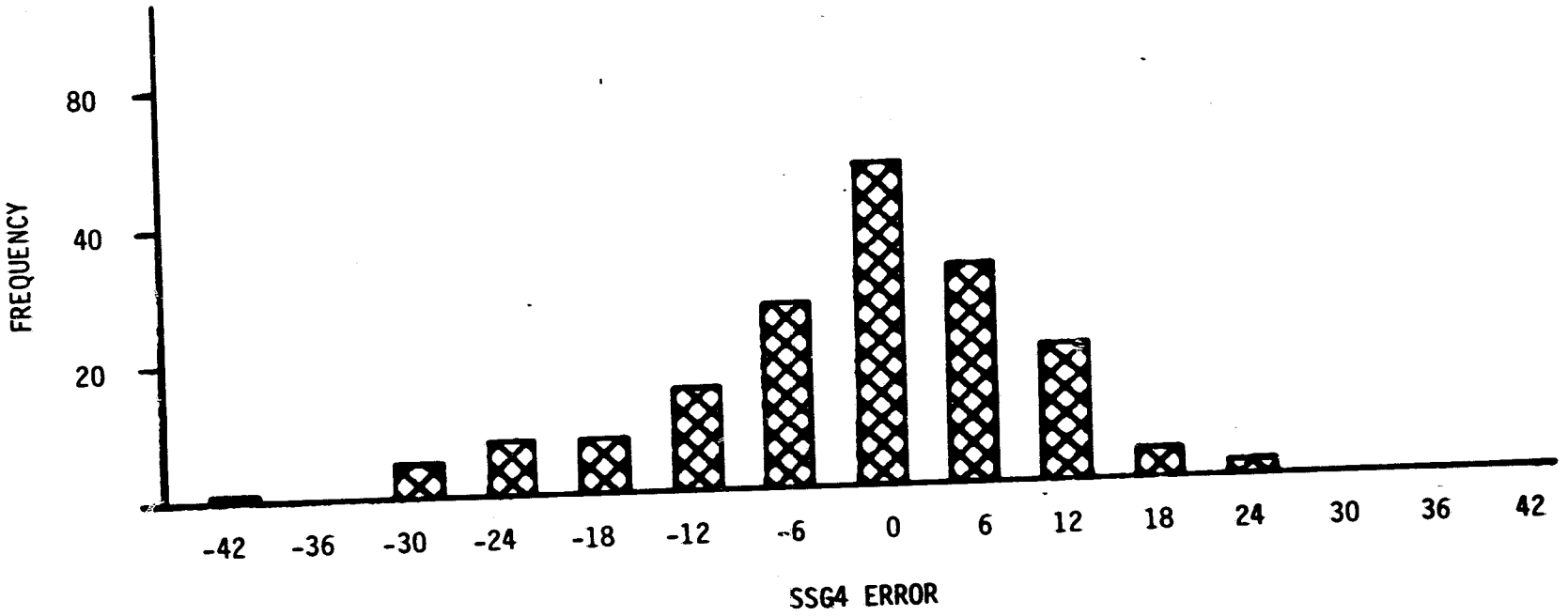
SSG3B ERROR VERSUS GROUND TRUTH PROPORTION



9/28/81

DISTRIBUTION OF SSG4 ERRORS

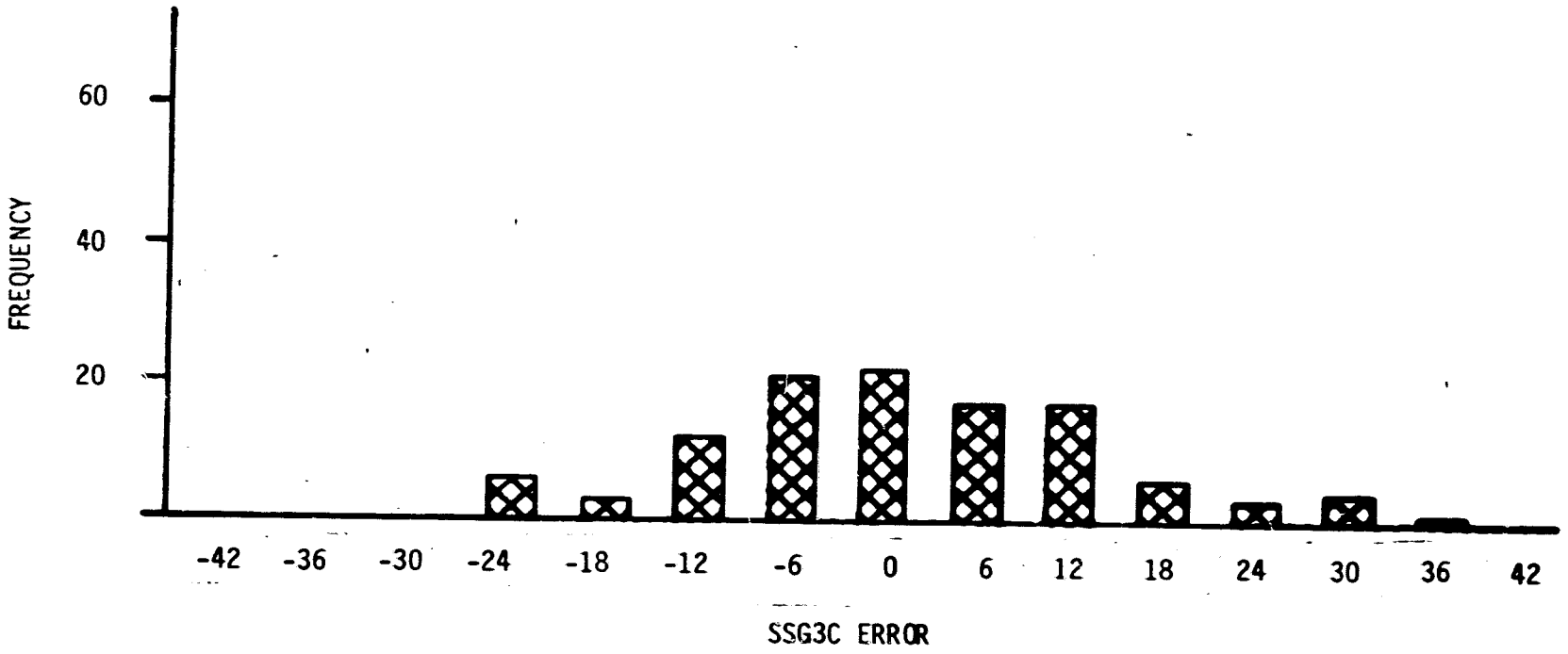
OVER FOUR YEARS: 1976-1979



9/28/81

DISTRIBUTION OF SSG3C ERRORS

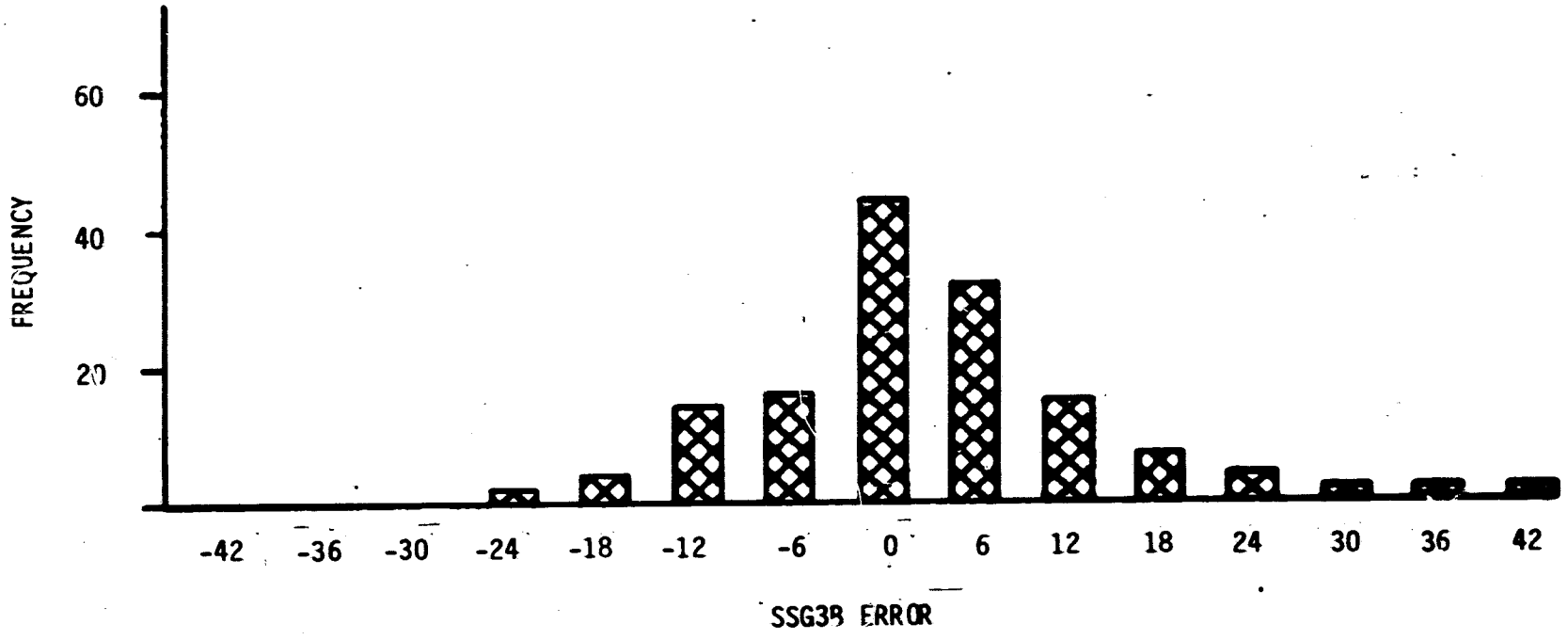
OVER FOUR YEARS: 1976-1979



9/28/81

DISTRIBUTION OF SSG3B ERRORS

OVER FOUR YEARS: 1976-1979



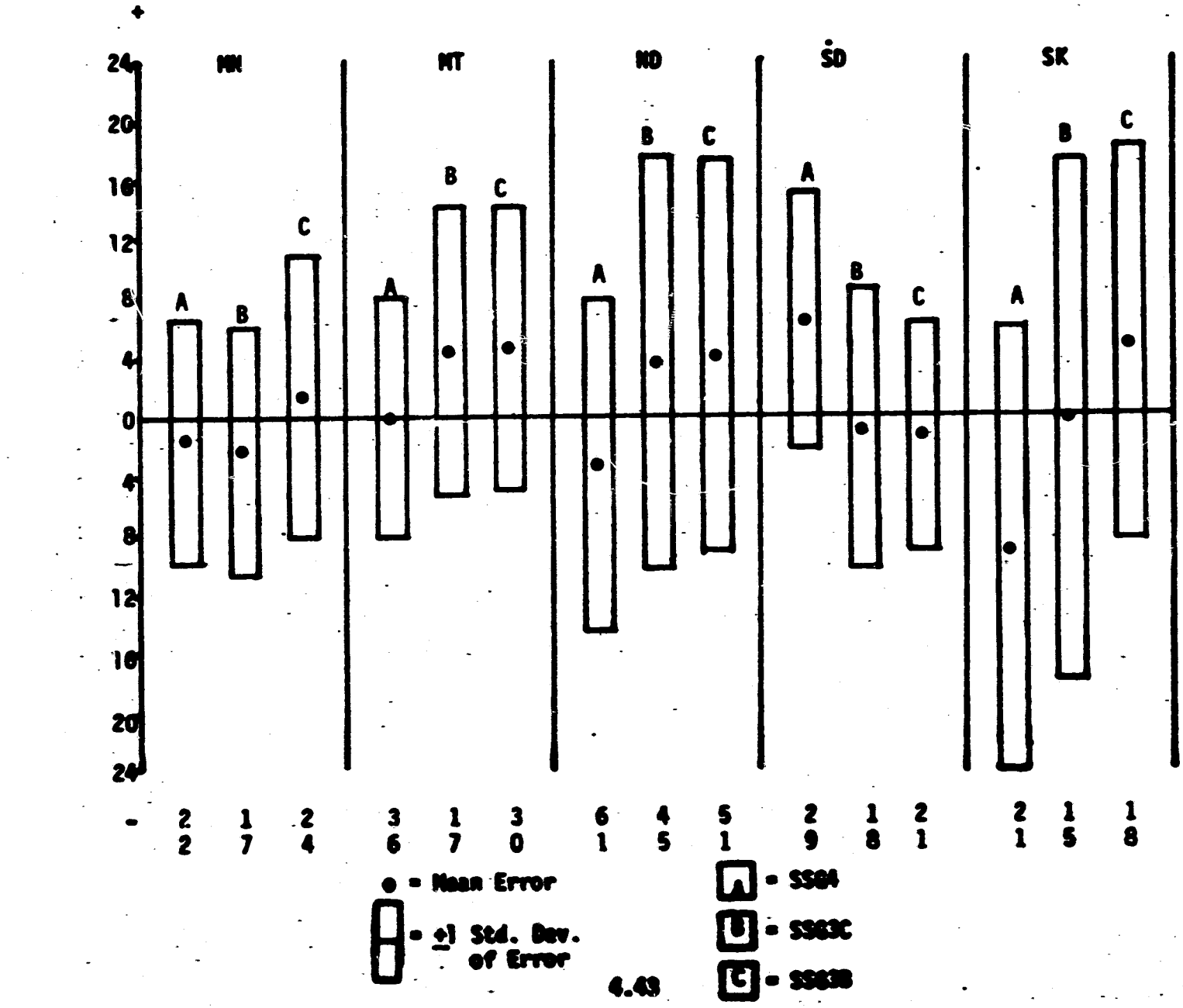
9/28/81

PERFORMANCES OF SSG4, SSG3C AND SSG3B BY STATE

STATISTIC	MN			MT			ND			SD			SK		
	SSG4	SSG3C	SSG3B	SSG4	SSG3C	SSG3B	SSG4	SSG3C	SSG3B	SSG4	SSG3C	SSG3B	SSG4	SSG3C	SSG3B
$\bar{e}$	-1.70	-2.41	1.42	-0.56	4.23	4.45*	-3.74*	3.89	4.05*	6.50*	-1.22	-1.35	-9.40*	-0.67	4.89
S_e	8.37	8.28	9.68	8.06	9.92	9.98	11.50	14.04	12.38	9.34	8.81	7.93	15.26	17.39	13.39
MAE	6.40	7.10	7.47	4.88	8.23	7.64	9.47	11.31	9.85	9.84	7.40	6.35	3.45	14.04	9.90
RME	-6.40	-11.41	6.28	-5.70	36.50	45.09	-10.19	11.41	11.39	37.46	-6.98	-7.58	-22.55	-1.60	11.86
$\bar{p}$	26.55	21.13	22.61	9.82	11.59	9.87	36.71	34.09	35.55	17.35	17.47	17.80	41.69	42.00	41.22
n	22	17	24	36	17	30	61	45	51	29	18	21	21	15	18

* Indicates that the mean error was significantly different from zero at the 10% level of significance.

PERFORMANCES OF SS64, SS63C AND SS63B BY STATE



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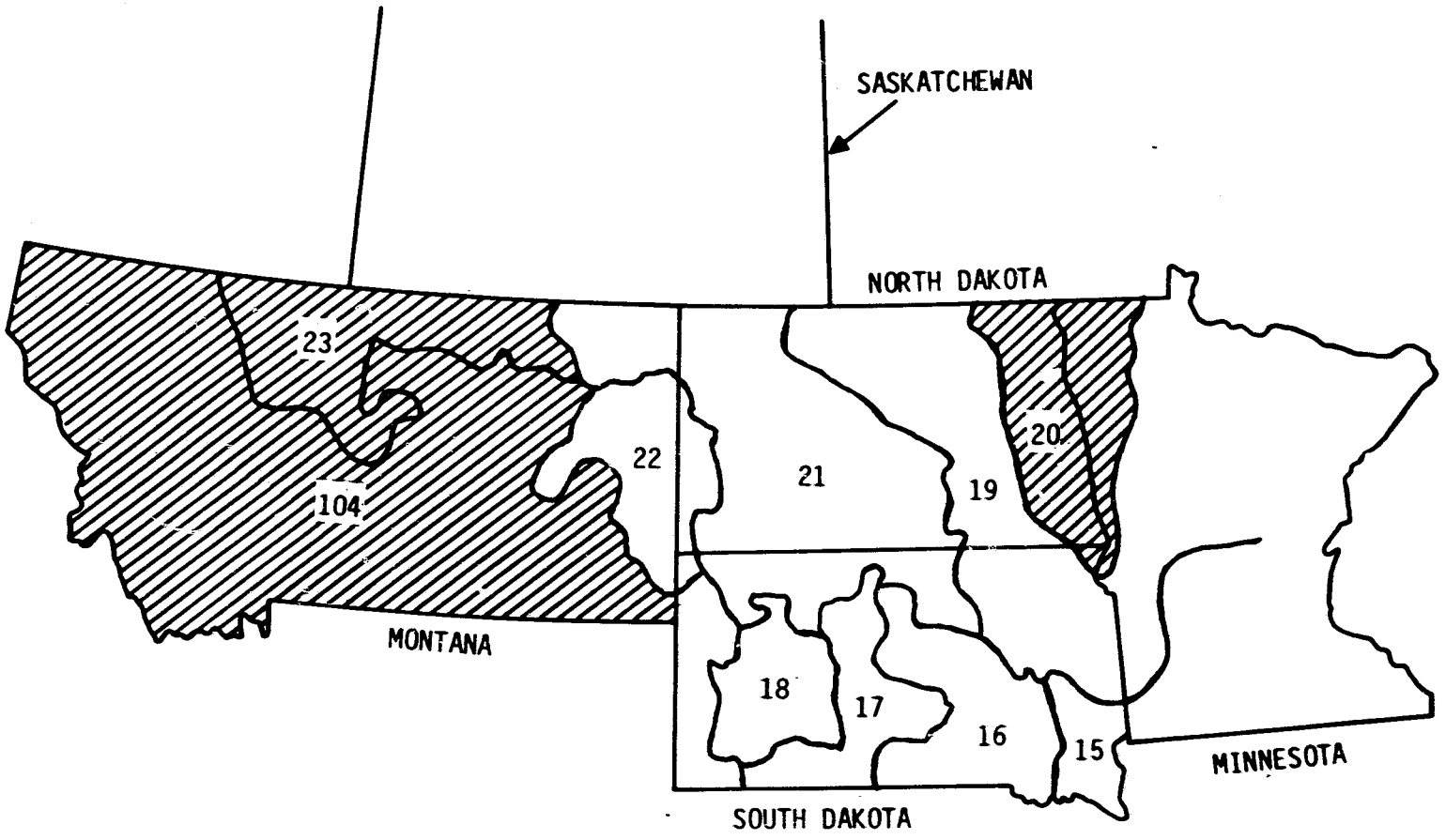
APU AND U.S.S.R. FSR BOUNDARIES



APU = AGROPHYSICAL UNIT
U.S.S.R. FSR = U.S.S.R. FOREIGN SIMILARITY REGION

PERFORMANCES OF SSG4, SSG3C AND SSG3B BY REGION

STATISTIC	APU19			APU20			APU 21			USSR-FSR		
	SSG4	SSG3C	SSG3B	SSG4	SSG3C	SSG3B	SSG4	SSG3C	SSG3B	SSG4	SSG3C	SSG3B
$\bar{e}$	-2.51	2.44	3.36	-2.23	0.37	2.97	-4.77*	3.00	2.66	-2.14	0.27	3.67
S_e	10.81	11.88	11.49	11.40	10.62	9.46	10.93	16.04	13.77	10.91	9.98	10.88
MAE	9.16	9.67	9.28	8.15	8.53	7.39	8.99	12.59	9.98	7.49	8.03	8.16
RME	-7.19	7.29	9.53	-4.60	0.81	6.55	-20.52	13.37	12.33	-5.55	0.65	10.31
$\bar{p}$	34.92	33.45	35.27	48.49	45.86	45.34	23.25	22.43	21.57	38.56	41.75	35.61
n	32	24	29	25	16	21	36	25	28	34	19	30

APU 19 = PORTIONS OF ND, SD, MN

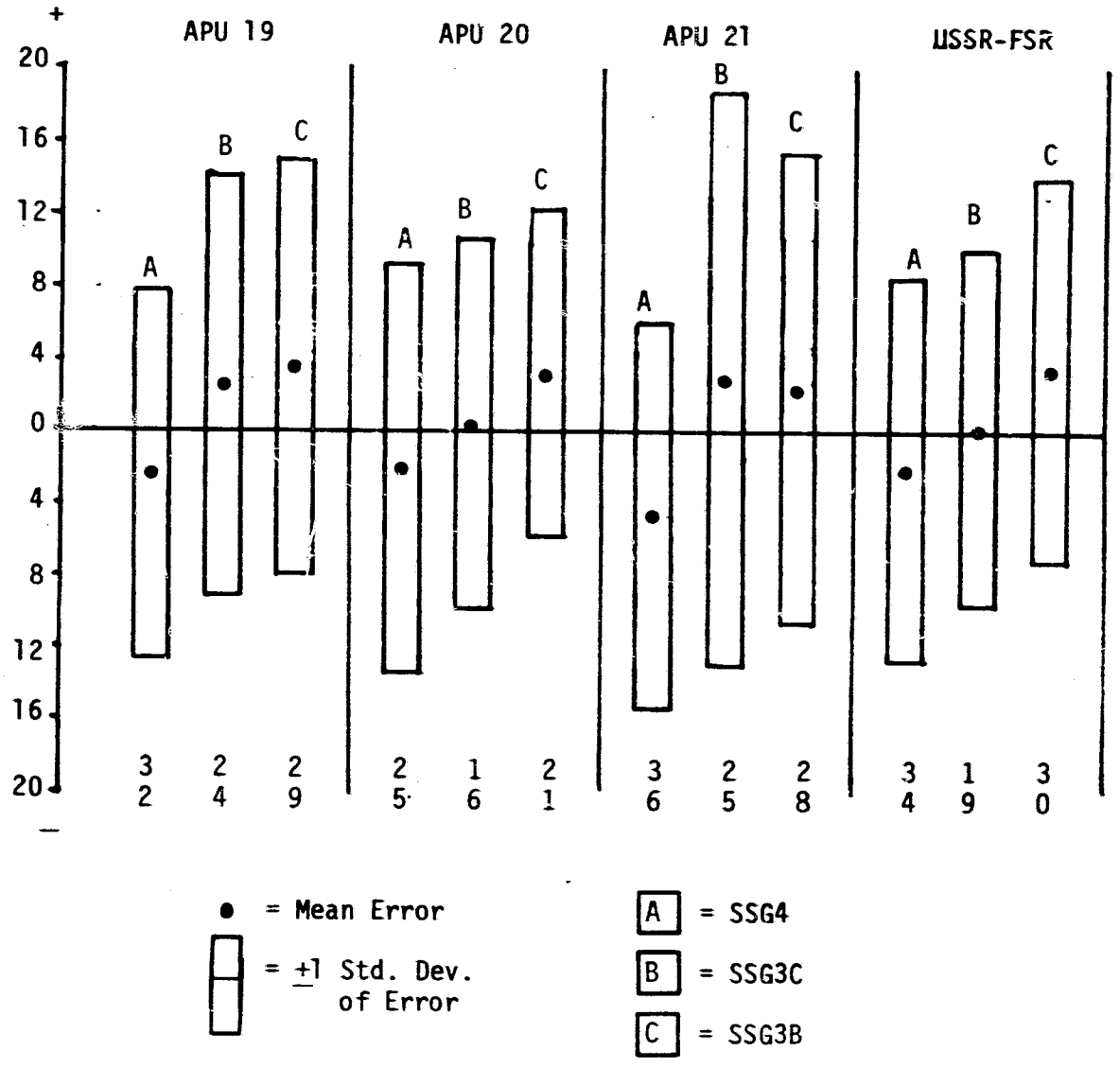
APU 20 = PORTIONS OF ND, MN

APU 21 = PORTIONS OF MT, ND, SD

USSR-FSR = PORTIONS OF APU 104 - MT, APU 20 - ND/MN, APU 23 - MT.

* Indicates that the mean error was significantly different from zero at the 10% level of significance.

PERFORMANCES OF SSG4, SSG3C AND SSG3B BY REGION



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PERFORMANCE OF SSG4 VERSUS SSG3C OVER COMMON SEGMENTS

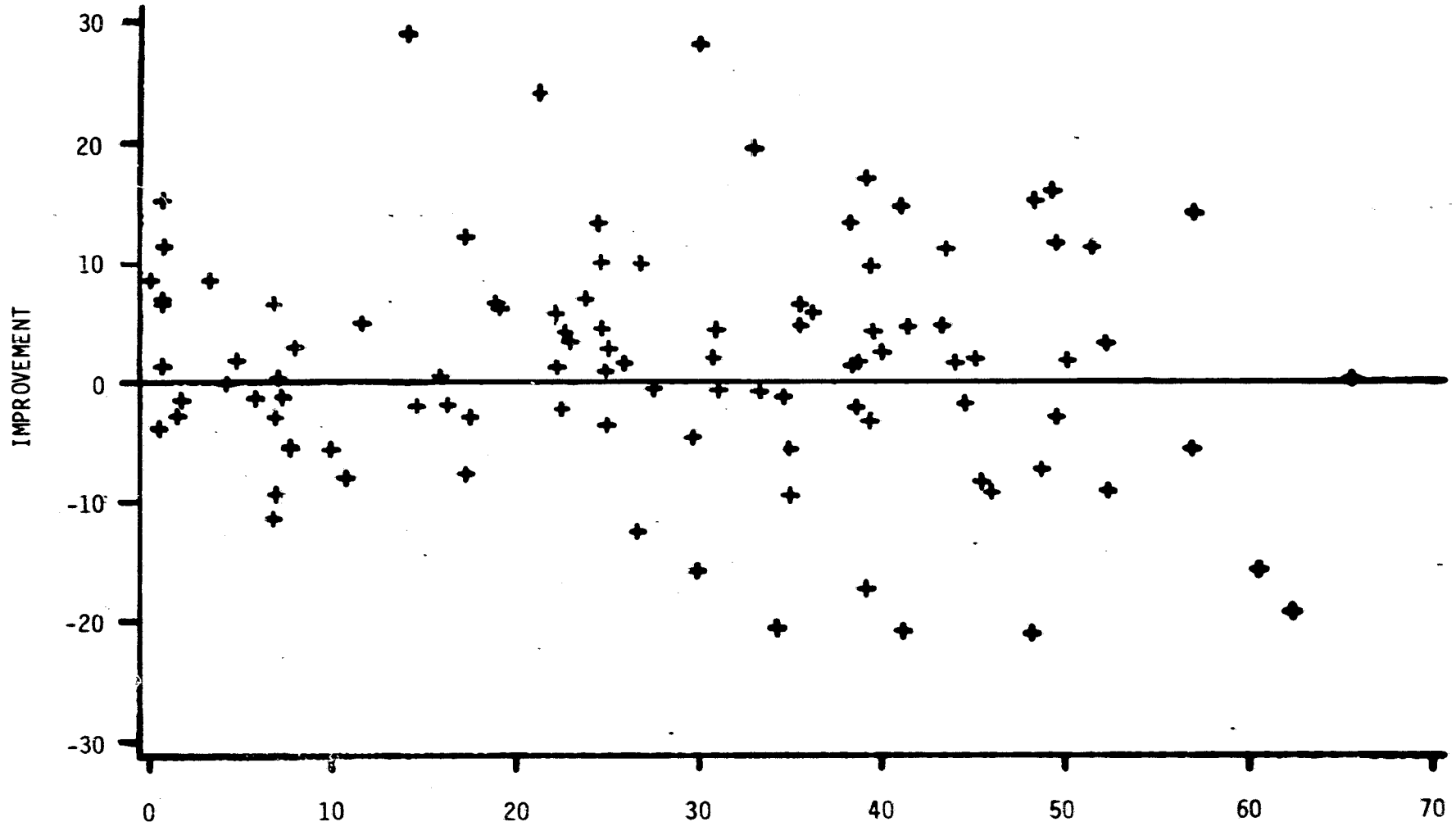
YEAR	PROC	$\bar{e}$	S_e	MAE	RME	$\bar{p}$	n
ALL YEARS	SSG4	-1.55	10.90	8.32	-5.63	27.72	101
	SSG3C	1.33	12.63	9.88	4.80		
1976	SSG4	-5.46*	11.86	9.83	-19.09	28.61	20
	SSG3C	4.64*	9.32	8.13	16.22		
1977	SSG4	2.62	10.51	8.26	9.36	27.98	20
	SSG3C	2.19	10.94	9.04	7.83		
1978	SSG4	-2.00	9.81	7.31	-7.42	26.97	47
	SSG3C	-1.36	11.37	8.75	-5.04		
1979	SSG4	-0.53	12.46	9.63	-1.85	28.62	14
	SSG3C	4.39	20.31	17.33	15.34		

*INDICATES THAT THE MEAN ERROR WAS SIGNIFICANTLY DIFFERENT FROM ZERO AT THE 10% LEVEL OF SIGNIFICANCE.

9/28/81

IMPROVEMENT OF SSG4 OVER SSG3C VERSUS GROUND TRUTH

FOR COMMON SEGMENTS



$$\text{IMPROVEMENT}_i = |\hat{P}_i - P_i|_{SSG3C} - |\hat{P}_i - P_i|_{SSG4}$$

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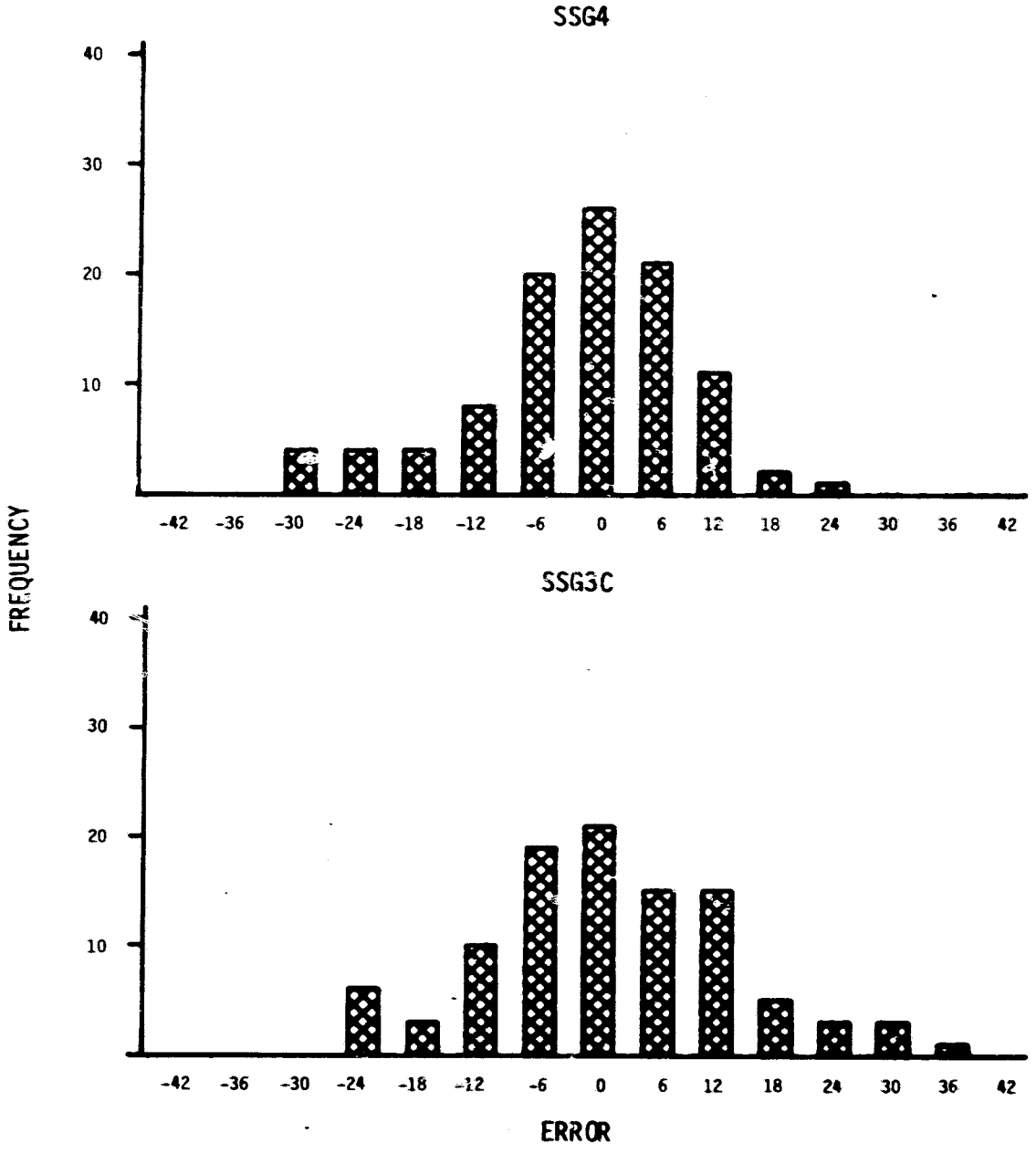
DISTRIBUTION OF PROPORTION ERRORS OVER ALL YEARS FOR SEGMENTS COMMON TO SSG4 AND SSG3C



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PERFORMANCE OF SSG3C VERSUS SSG3B OVER COMMON SEGMENTS

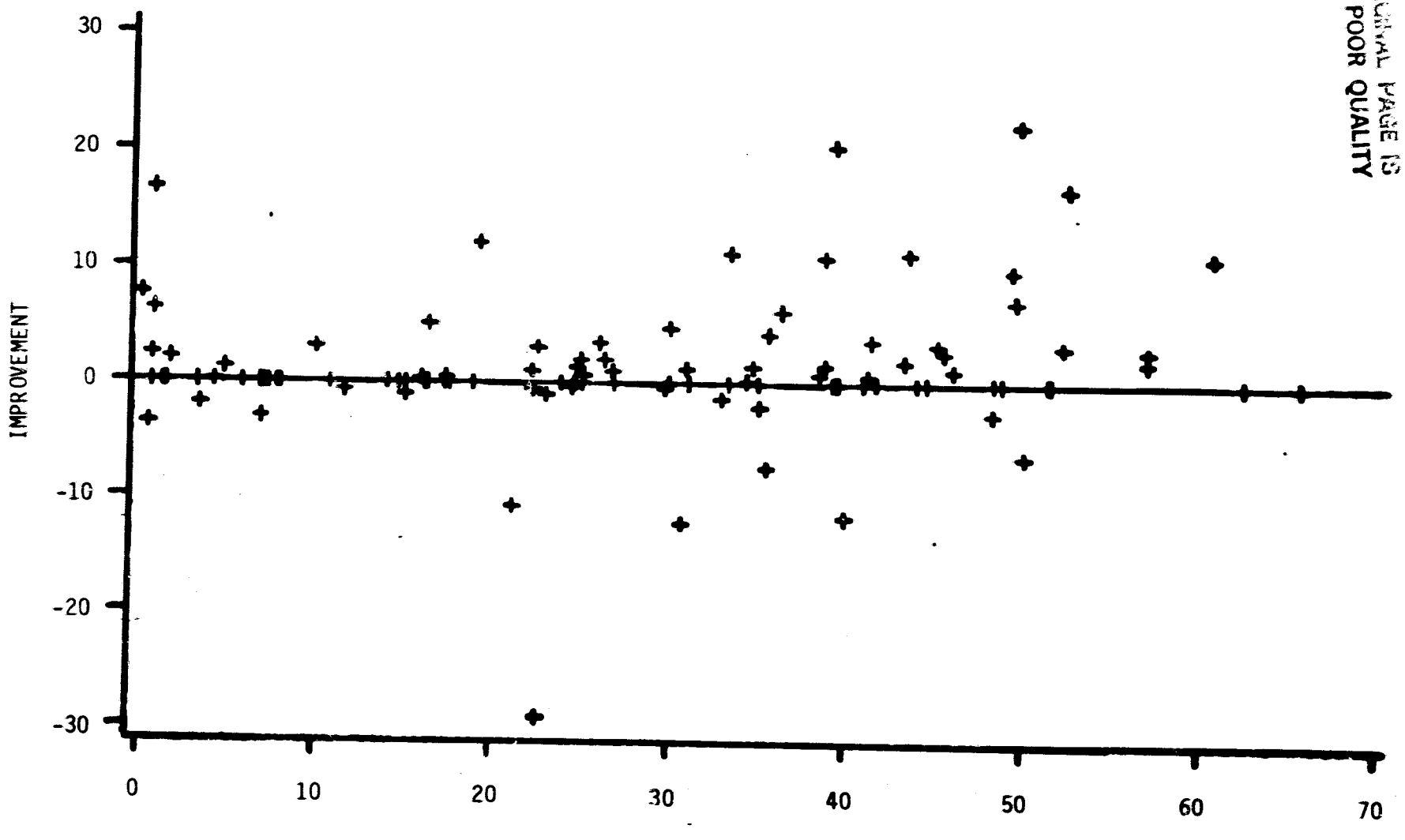
YEAR	PROC	$\bar{e}$	S_e	MAE	RME	$\bar{p}$	n
ALL YEARS	SSG3C	1.36	12.17	9.58	5.01	27.16	107
	SSG3B	2.86*	11.14	8.28	10.53		
1976	SSG3C	5.73*	7.55	7.35	20.99	27.30	20
	SSG3B	4.54*	6.14	5.13	16.63		
1977	SSG3C	1.54	10.66	8.88	5.51	27.95	24
	SSG3B	2.01	9.10	7.49	7.19		
1978	SSG3C	-1.51	11.05	8.73	-5.77	26.15	48
	SSG3B	-0.04	9.51	7.61	-0.15		
1979	SSG3C	4.46	19.53	16.40	15.42	28.93	15
	SSG3B	11.26*	18.41	15.87	38.85		

*INDICATES THAT THE MEAN ERROR WAS SIGNIFICANTLY DIFFERENT FROM ZERO AT THE 10% LEVEL OF SIGNIFICANCE.

9/28/81

IMPROVEMENT OF SSG3B OVER SSG3C VERSUS GROUND TRUTH

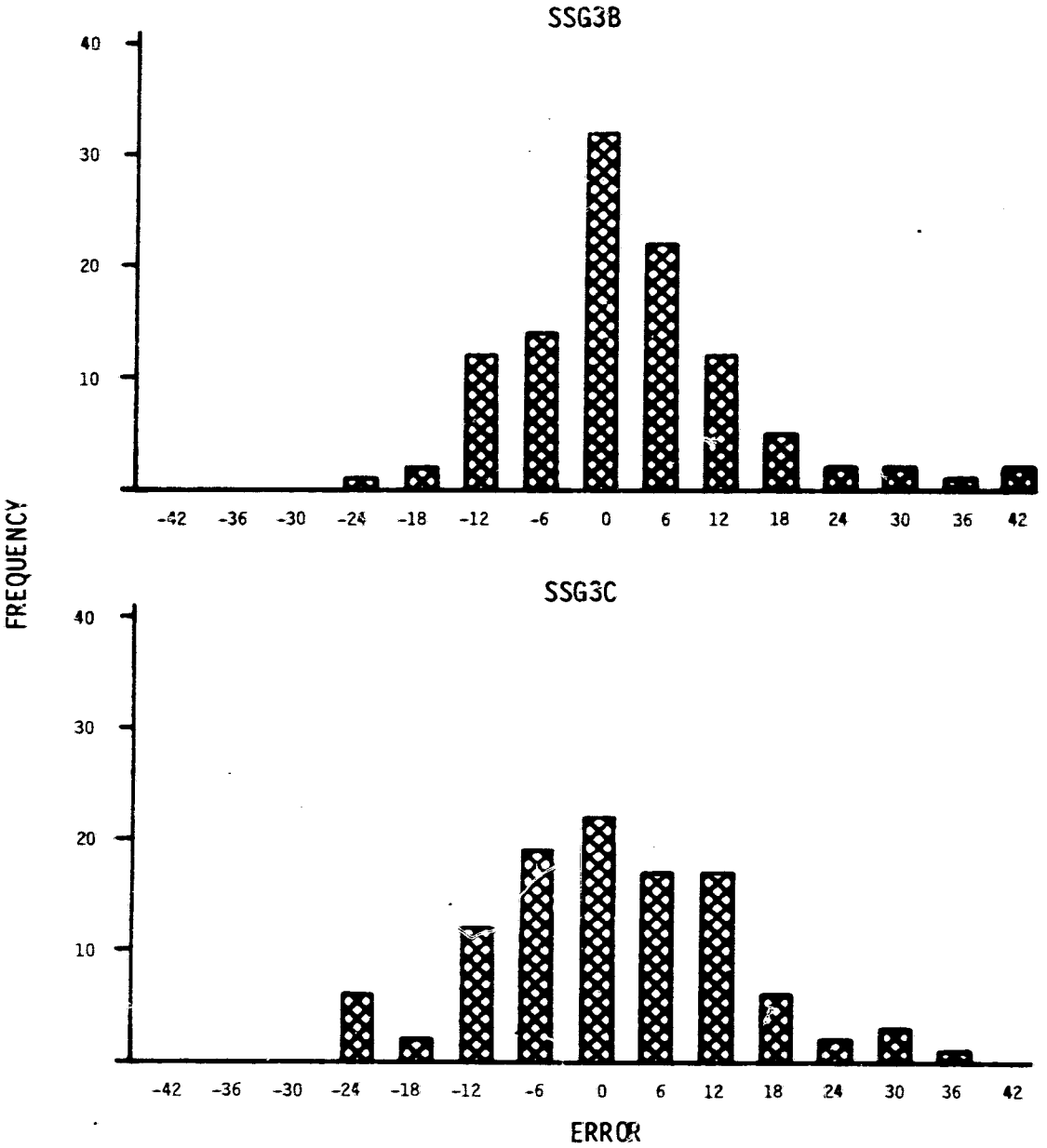
FOR COMMON SEGMENTS



$$\text{IMPROVEMENT}_i = |\hat{P}_i - P_i|_{SSG3C} - |\hat{P}_i - P_i|_{SSG3B}$$

9/28/81

DISTRIBUTION OF ERRORS OVER ALL YEARS FOR SEGMENTS COMMON TO SSG3C AND SSG3B



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9/28/81

SUMMARY OF ACCURACY RESULTS

BASED ON THIS EXPERIMENT:

- AUTOMATED PROCEDURES COMPARABLE IN ACCURACY TO PROCEDURES WITH ANALYST LABELING
- NO APPARENT DIFFERENCES IN ACCURACY BETWEEN THE TWO AUTOMATIC PROCEDURES: I.E., SSG4 AND SSG3C
- SIGNIFICANT IMPROVEMENT IN ACCURACY USING ANALYST INTERVENTION IN ACQUISITION SELECTION FOR CAESAR
- FOREIGN ADAPTION OF AUTOMATED PROCEDURES APPEARS ENCOURAGING

U.S./CANADA SPRING SMALL GRAINS PILOT EXPERIMENT

Proportion Estimation Technical Conclusions and Recommendations Summary

- The accuracy and rate of processability of the first generation automated proportion estimation procedures are comparable to procedures requiring extensive analyst intervention.

- Major factors which influence proportion estimation accuracy:
  - oo Acquisition history
  - oo Designation of biowindow periods for available acquisitions.

- Specific issues/recommendations that should be addressed are:

SSG3C and SSG4, Proportion Estimation Procedures

- Automation of data preprocessing functions to increase efficiency (cloud cover, registration, etc.).
- Improvement of biowindow model designation of acquisitions.
- Develop methods to minimize the effect of errors in biowindow designation of acquisitions by developing an augmentation to the decision logic.

SSG3C Proportion Estimation Procedure (only)

- Quantify and, if necessary, develop techniques to correct for the bias introduced by:
  - oo Overlap of distribution functions
  - oo Treatment of boundary pixels
  - oo Instability of the vegetative index
  - oo Treatment of clouds and cloud shadows
  - oo Non-optimal estimation of decision logic parameters (decision boundaries)
  - oo The dependence of the proportion estimation error to the number of acquisitions used.

SSG4 Proportion Estimation Procedure

- Sources of bias not modeled by the bias correction need to be quantified. Techniques for correction of these need to be developed, if necessary. Some of these bias sources are:
  - oo Earliness of the third acquisition
  - oo Treatment of boundary pixels
  - oo Commission errors inherent in the procedure
  - oo Non-optimal selection of spectral appearance sequences to label spring small grains.

Other Technology Needs

- Development of early-season and through-the-season area estimation systems.
- Extension of technology to spring and winter grains (with emphasis on the USSR)
- Extension of the area estimation technology to treat long growing seasons and abandonment of small grains (with emphasis on Australia).

SENSITIVITY TO LANDSAT DATA COLLECTION FOR THREE SMALL GRAIN PROCESSING PROCEDURES

M. M. SMYRSKI
9/28/81

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	SEGS.	YEAR(S)	DATE	TEST PERIOD	
									FROM	TO
8	PILOT (SENSITIVITY STUDY)	HISTORICAL SSG4 SSG3B SSG3C	AREA ESTIMATION	SUBSYSTEM	MN, MT, ND, SD, SASK.	331	1976 1977 1978 1979	9/28/81	8/81	9/81

RATE OF PROCESSABILITY SENSITIVITY STUDY

- OBJECTIVE: OBSERVE THE DIFFERENCES IN THE HISTORICAL RATES OF PROCESSABILITY AND THE PROCESSABILITY RATES OF SSG4, SSG3B, AND SSG3C.
- APPROACH:
  - PROCESSABILITY FOR A PROCEDURE IS DETERMINED BY DIVIDING THE NUMBER OF SEGMENTS WITH PROPORTION ESTIMATES BY THE TOTAL NUMBER OF SEGMENTS ATTEMPTED.
- DATA:
  - NUMBER OF SEGMENTS ATTEMPTED BY ALL PROCEDURES = 331

PROCESSABILITY RATES

	HISTORICAL*	SSG4	SSG3B	SSG3C	N
OVERALL YEARS AND STATES	219 66.2%	220 66.5%	190 57.4%	156 47.1%	331
1976	48 82.8%	40 69.0%	34 58.6%	24 41.4%	58
1977	61 68.5%	42 47.2%	39 43.8%	28 31.5%	89
1978	79 55.2%	113 79.0%	100 70.0%	91 63.6%	143
1979	31 75.6%	25 61.0%	17 41.5%	13 31.7%	41

STATE	HISTORICAL*	SSG4	SSG3B	SSG3C	N
MN	27 61.4%	22 50.0%	25 56.8%	18 40.9%	44
MT	47 71.2%	43 65.2%	36 54.6%	21 31.8%	66
ND	99 61.6%	110 67.9%	95 58.6%	87 53.7%	162
SD	34 73.9%	32 69.6%	23 50.0%	20 43.5%	46
SK FOR 1978	12 92.3%	13 100%	11 84.6%	10 76.9%	13

*HISTORICAL PROCEDURES
1976 - PHASE II DETAILED ANALYSIS PROCEDURE
1977 - PHASE III DETAILED ANALYSIS PROCEDURE
1978 - TRANSITION YEAR DETAILED ANALYSIS PROCEDURE
1978 - SASKATCHEWAN STUDY DETAILED ANALYSIS PROCEDURE
1979 - 1980 EXPLORATORY DETAILED ANALYSIS PROCEDURE

9/28/81

NUMBER OF SEGMENTS PROCESSED BY SSG3B, SSG3C, SSG4 AS COMPARED TO THOSE FOR HISTORICAL PROCEDURES

	CANDIDATE SEGMENTS ATTEMPTED BY HISTORICAL PROCEDURES	SSG4		SSG3B		SSG3C	
		ESTIMATE	NO ESTIMATE	ESTIMATE	NO ESTIMATE	ESTIMATE	NO ESTIMATE
GROUND-TRUTH SEGMENTS	PROCESSED	127	59	110	76	87	99
186		68.3%	31.7%	59.1%	40.9%	46.8%	53.2%
	NOT PROCESSED	45	35	37	43	31	49
80		56.3%	43.8%	46.3%	53.8%	38.8%	61.3%
NONGROUND-TRUTH SEGMENTS	PROCESSED	30	3	27	6	24	9
33		90.9%	91%	81.8%	18.2%	72.7%	27.3%
	NOT PROCESSED	18	14	16	16	14	18
32		56.3%	43.8%	50%	50%	43.8%	56.3%

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	SEGS.	YEAR(S)	DATE	TEST PERIOD	
									FROM	TO
8	PILOT (SENSITIVITY STUDY)	HISTORICAL SSG4, SSG2B, SSG3C	AREA ESTIMATION	SUBSYSTEM	MN, MT, ND, SD, SASK.	331	1976 1977 1978 1979	9/28/81	8/81	9/81
TEST RESULTS - PROCESSABILITY RATES										

- OVERALL:
  - SSG4 COMPARABLE TO HISTORICAL PROCEDURES.
  - SSG3B SLIGHTLY LOWER.
  - SSG3C MUCH LOWER.
- COMPARISON BY YEARS:
  - HISTORICAL PROCEDURES HAVE HIGHEST PROCESSABILITY RATE.
- COMPARISON BY STATES:
  - NO SIGNIFICANT DIFFERENCES.
- COMPARISON OF SEGMENTS PROCESSED BY SSG4, SSG3B, AND SSG3C TO HISTORICAL PROCEDURES:
  - ESTIMATES OBTAINED ON SUBSTANTIALLY DIFFERENT SETS OF SEGMENTS.

PROCESSABILITY RATES

	HISTORICAL*	SSG4	SSG3B	SSG3C	N
OVERALL YEARS AND STATES	219 66.2%	220 66.5%	190 57.4%	156 47.1%	331
1976	48 82.8%	40 69.0%	34 58.6%	24 41.4%	58
1977	61 68.5%	42 47.2%	39 43.8%	28 31.5%	89
1978	79 55.2%	113 79.0%	100 70.0%	91 63.6%	143
1979	31 75.6%	25 61.0%	17 41.5%	13 31.7%	41

STATE	HISTORICAL*	SSG4	SSG3B	SSG3C	N
MN	27 61.4%	22 50.0%	25 56.8%	18 40.9%	44
MT	47 71.2%	43 65.2%	36 54.6%	21 31.8%	66
ND	99 61.6%	110 67.9%	95 58.6%	87 53.7%	162
SD	34 73.9%	32 69.6%	23 50.0%	20 43.5%	46
SK FOR 1978	12 92.3%	13 100%	11 84.6%	10 76.9%	13

*HISTORICAL PROCEDURES
1976 - PHASE II DETAILED ANALYSIS PROCEDURE
1977 - PHASE III DETAILED ANALYSIS PROCEDURE
1978 - TRANSITION YEAR DETAILED ANALYSIS PROCEDURE
1978 - SASKATCHEWAN STUDY DETAILED ANALYSIS PROCEDURE
1979 - 1980 EXPLORATORY DETAILED ANALYSIS PROCEDURE

9/28/81

ACQUISITION HISTORY SENSITIVITY STUDY

M. M. SMYRSKI
9/28/81

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	SEGS.	YEAR(S)	DATE	TEST PERIOD	
									FROM	TO
9	PILOT (SENSITIVITY STUDY)	SSG4, SSG3B, SSG3C	AREA ESTIMATION	SUBSYSTEM	MN, MT, ND, SD, SASK.	189	1976 1977 1978 1979	9/28/81	8/81	9/81

ACQUISITION HISTORY SENSITIVITY STUDY

- OBJECTIVE: ASSESS THE EFFECT OF THE NUMBER OF BIOWINDOW/PERIODS AVAILABLE FOR PROCESSING ON PROPORTION ESTIMATION ERROR.

- DATA: SOME ACQUISITIONS BECAME UNAVAILABLE FOR PROCESSING DUE TO MISREGISTRATION (CORRECTABLE) AND CLOUD COVER (UNCORRECTABLE).

- MISREGISTRATION: PERCENT OF ACQUISITIONS LOST DUE TO MISREGISTRATION FOR ALL PROCEDURES (SSG4. SSG3B. SSG3C)

PERCENT	1976	1977	1978	1979
LOST	0.4	1.1	1.7	14.4

- CLOUD COVER: EACH PROCEDURE SPECIFIES THE MAXIMUM PERCENT CLOUD COVER ALLOWED PER ACQUISITION BEFORE AN ACQUISITION IS CONSIDERED UNUSABLE. SSG4 ALLOWS UP TO 10 PERCENT COVER; SSG3B AND SSG3C ALLOW UP TO 20 PERCENT COVER.

PERCENT OF ACQUISITIONS LOST DUE TO CLOUD COVER

SSG38 AND SSG3C

PERCENT	1976	1977	1978	1979
LOST	5.8	8.2	8.7	11.2

SSG4

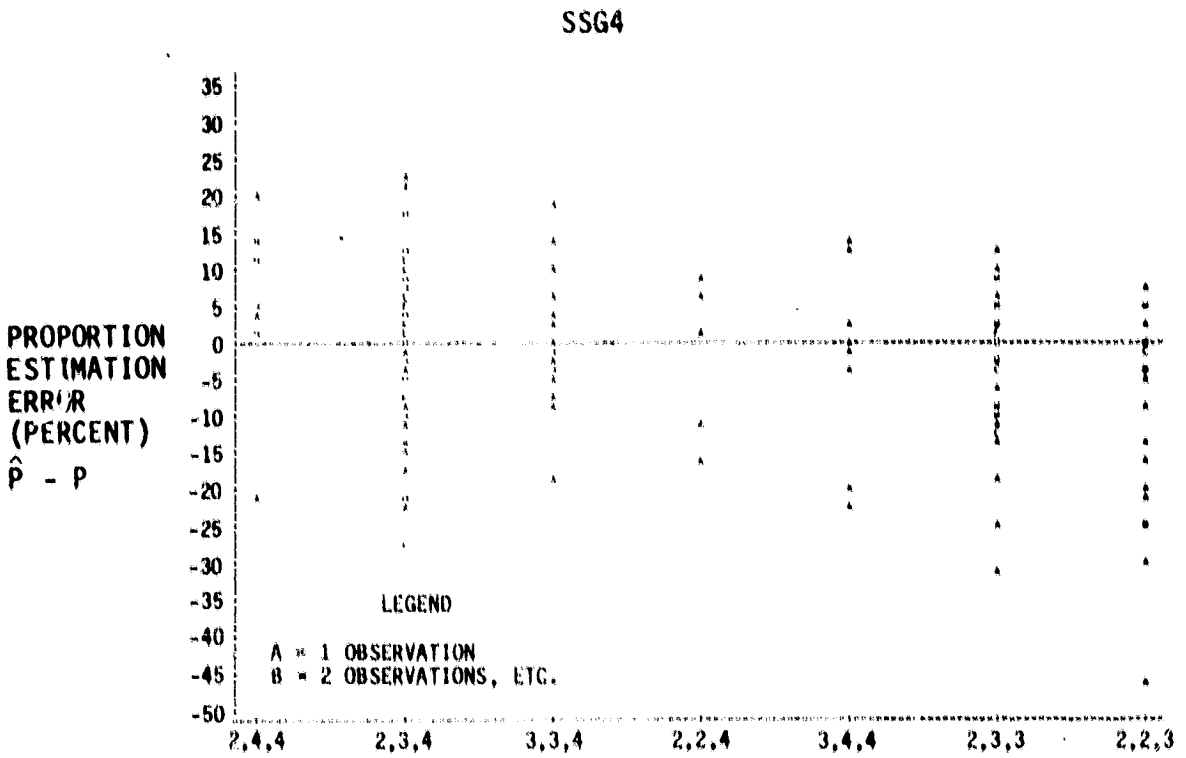
PERCENT	1976	1977	1978	1979
LOST	9.8	13.1	12.3	17.1

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	SEGS.	YEAR(S)	DATE	TEST PERIOD	
									FROM	TO
9	PILOT (SENSITIVITY STUDY)	SSG4, SSG3B, SSG3C	AREA ESTIMATION	SUBSYSTEM	MN, MT, ND, SD, SASK.	189	1976 1977 1978 1979	9/28/81	8/31	9/81

- SIGNIFICANTLY LARGE OVERESTIMATION OCCURS WHEN ACQUISITIONS FOR ONLY THREE WINDOW/PERIODS ARE USED IN SSG3B AND SSG3C.
- THOUGH OVERESTIMATION IS OBSERVED WHEN FIVE WINDOW/PERIODS ARE USED IN SSG3B, THIS EFFECT IS THOUGHT TO BE SPURIOUS. FURTHER EXAMINATION IS UNDERWAY.
- WHENEVER A LARGE NUMBER OF WINDOW/PERIODS (~7) ARE USED, SIGNIFICANT UNDERESTIMATION IS OBSERVED FOR SSG3C. A SIMILAR PATTERN EXISTS FOR SSG3B; HOWEVER, THE SAMPLE IS TOO SMALL FOR SIGNIFICANCE.
- SEGMENT DESIGNATIONS OF WINDOWS 2,3,4 APPEAR TO GIVE UNBIASED RESULTS AS EXPECTED FOR SSG4.
- WHEN NO ACQUISITION IN WINDOW 4 IS AVAILABLE, SIGNIFICANT UNDERESTIMATION OCCURS FOR SSG4.
- SIGNIFICANT OVERESTIMATION BY SSG4 OCCURS WHEN THE SEGMENT DESIGNATION IS 2,4,4. FURTHER EXAMINATION IS UNDERWAY.

9/28/81

ERROR VERSUS THE COMBINATIONS OF WINDOWS USED FOR PROCESSING

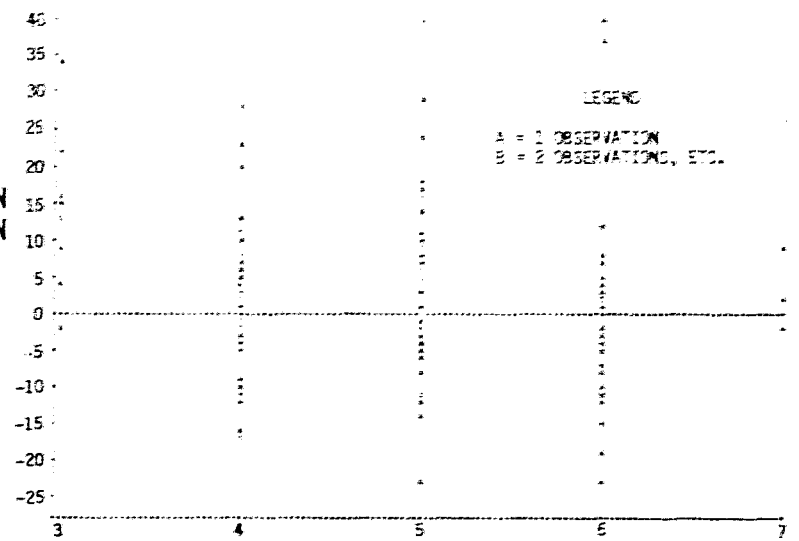


COMBINATION	MEAN ERROR, $\bar{e}$	STD. DEV. OF ERROR S_e	TOTAL, N
2, 4, 4	5.9*	10.8	11
2, 3, 4	.04	11.2	71
3, 3, 4	-0.1	9.1	16
2, 2, 4	-2.3	10.7	5
3, 4, 4	-2.3	13.2	8
2, 3, 3	-3.5*	9.5	37
2, 2, 3	-9.7*	13.9	21

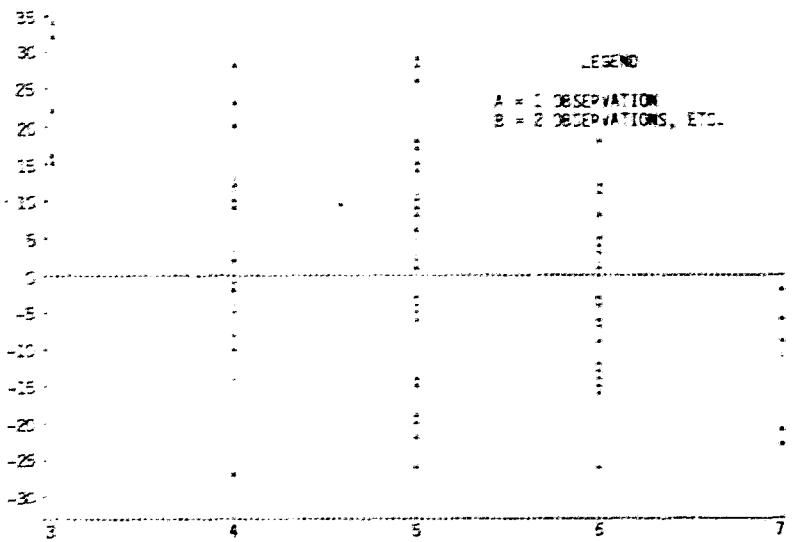
*SIGNIFICANT AT THE 10% LEVEL

ERROR VERSUS THE NUMBER OF WINDOW/PERIODS USED FOR PROCESSING

SSG3B



SSG3C



PROPORTION ESTIMATION ERROR (PERCENT) $\hat{P} - P$

NUMBER OF WINDOW/PERIODS USED

WINDOW/PERIODS USED	MEAN ERROR, $\bar{e}$	STD. DEV. OF ERROR S_e	TOTAL, N
3	14.7	10.9	9
4	1.7	9.4	46
5	4.4*	10.5	55
6	-.8	13.6	31
7	2.9	5.6	3

WINDOW/PERIODS USED	MEAN ERROR, $\bar{e}$	STD. DEV. OF ERROR S_e	TOTAL, N
3	23.9*	9.0	5
4	2.3	11.6	30
5	2.8	12.6	42
6	-2.0	9.7	29
7	-12.0*	8.2	6

*SIGNIFICANT AT THE 10% LEVEL

9/28/81

PROPORTION ESTIMATION ERROR SENSITIVITY TO MOISTURE CONDITIONS

G. SMITH
9/28/81

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	SEGS.	YEAR(S)	DATE	TEST PERIOD	
									FROM	TO
10	PILOT (SENSITIVITY STUDY)	SSG4-SPATIAL/COLOR SEQUENCE SSG3B-SEMI-AUTO CAESAR SSG3C-AUTOMATIC CAESAR	AREA ESTIMATION	SUBSYSTEM	U.S./CANADA MN ND MT SK SD	189	1976 - 1979	9/28/81	8/81	9/81

TEST TITLE: PROPORTION ESTIMATION ERROR SENSITIVITY FOR MOISTURE CONDITION

- OBJECTIVE:

  ASSESS THE DEPENDENCE OF SPRING SMALL GRAIN PROPORTION ESTIMATION ERRORS FOR EACH OF THREE AUTOMATIC PROCEDURES ON DEVIATIONS FROM NORMAL CROP STAGE DEVELOPMENT (HEADING DATE DISTRIBUTION AND PLANTING DATE DISTRIBUTION) AND MOISTURE CONDITION.

- HYPOTHESIS:

  MOISTURE CONDITIONS AFFECT:

  - SPECTRAL RESPONSE
  - INITIATION OF CROP DEVELOPMENT
  - VARIABILITY OF CROP DEVELOPMENT

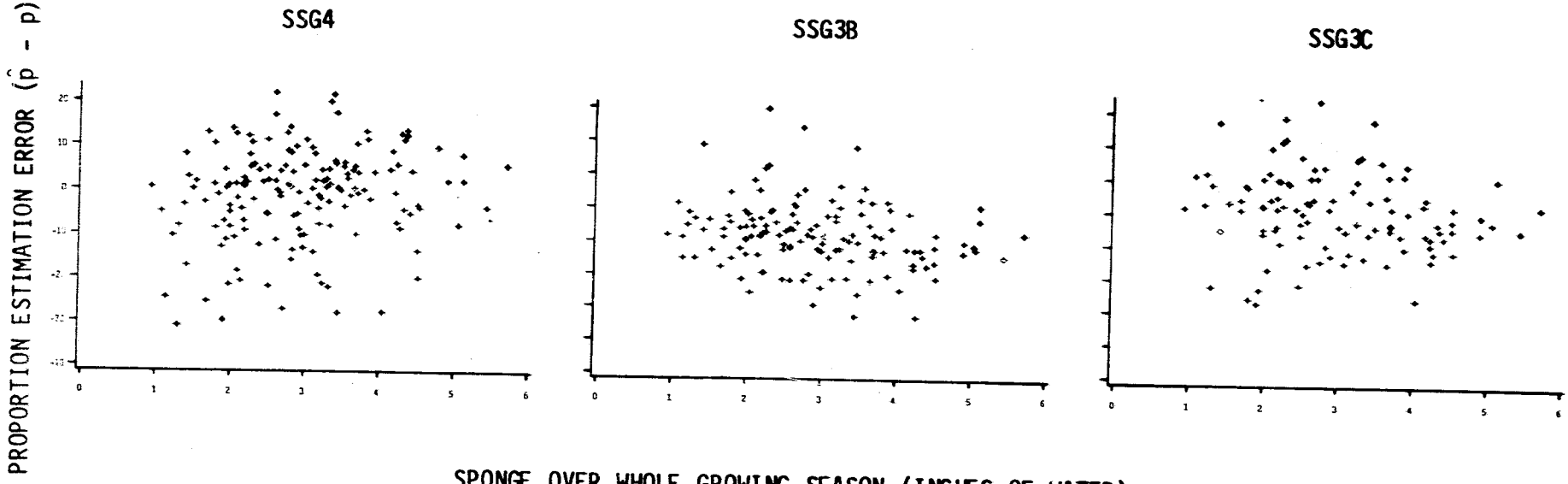
  AND CAUSE PROPORTION ESTIMATION ERROR.

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	SEGS.	YEAR(S)	DATE	TEST PERIOD	
									FROM	TO
10	PILOT (SENSITIVITY STUDY)	SSG4-SPATIAL/COLOR SEQUENCE SSG3B-SEMI-AUTO CAESAR SSG3C-AUTOMATIC CAESAR	AREA ESTIMATION	SUBSYSTEM	U.S./CANADA MN ND MT SK SD	189	1976 - 1979	9/28/81	8/81	9/81

Data Set Discussion

- Proportion estimation error ($\hat{P}-P$) for each procedure and all years (1976-1979)
- Ground truth
  - Planting date data by segment for 1979
  - Heading date data by segment for 1978 and 1979
- Modeled planting and heading date data and normal (historic) heading date data by segment for all years (1976-1979)
- Moisture (sponge) data over biostage and biowindow for each procedure by segment for all years (1976-1979)

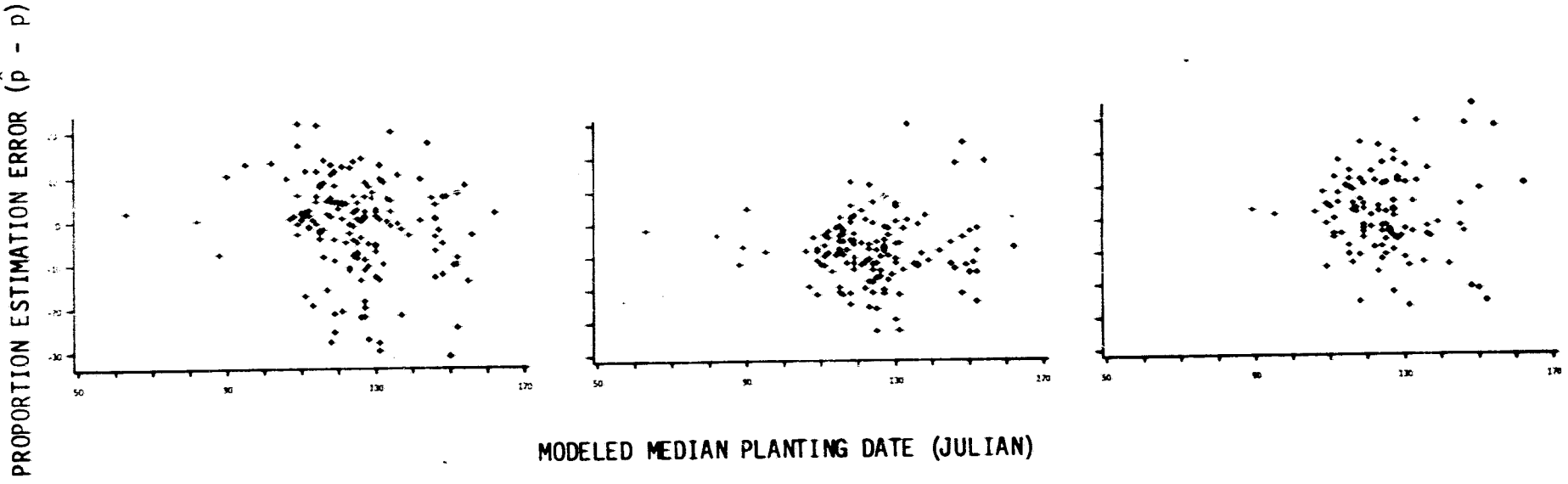
PROPORTION ESTIMATION ERROR VS. SPONGE OVER THE GROWING SEASON



NO DISCERNIBLE RELATIONSHIP WAS FOUND BETWEEN PROPORTION ESTIMATION ERROR AND SPONGE OVER BIOSTAGE OR BIOWINDOW FOR EACH OF THE PROCEDURES, BY YEAR, BY STATE, OR BY APU.

9/28/81

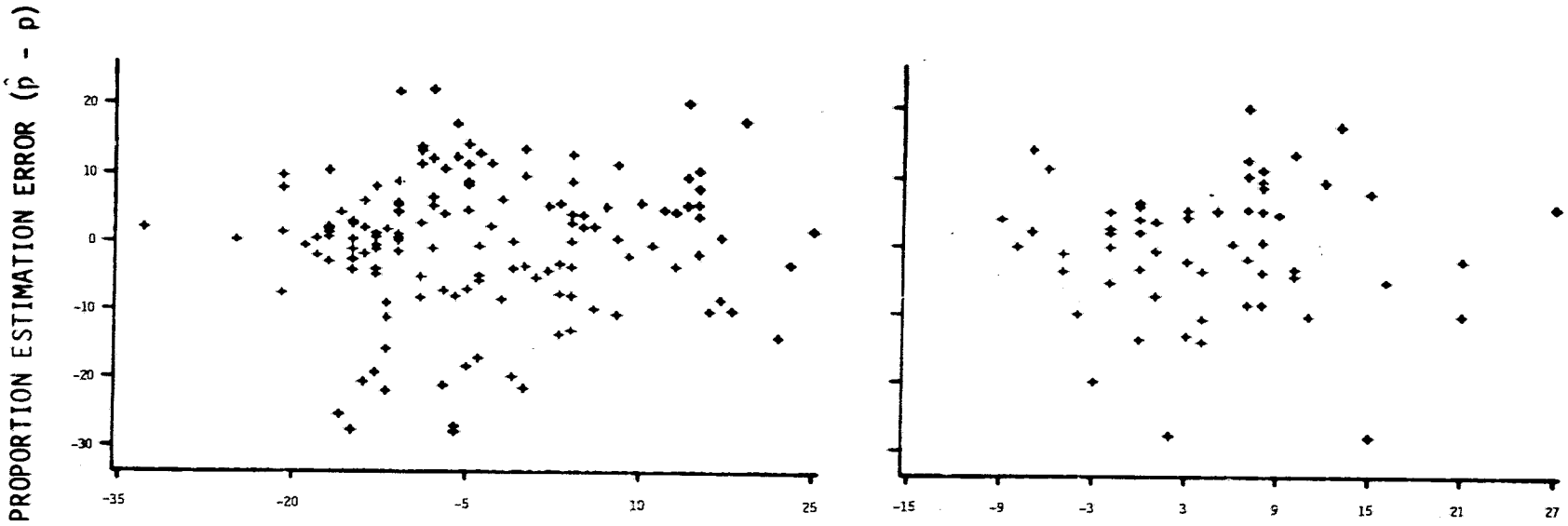
PROPORTION ESTIMATION ERROR VS. MEDIAN PLANTING DATE



NO DISCERNIBLE RELATIONSHIP WAS FOUND BETWEEN PROPORTION ESTIMATION ERROR AND MEDIAN-MODELED OR GROUND-TRUTH PLANTING DATE AND FIRST, LAST, OR RANGE IN PLANTING DATES BY YEAR, STATE, OR APU.

9/28/81

SSG4 ERROR VS. DEVIATION FROM NORMAL HEADING DATE



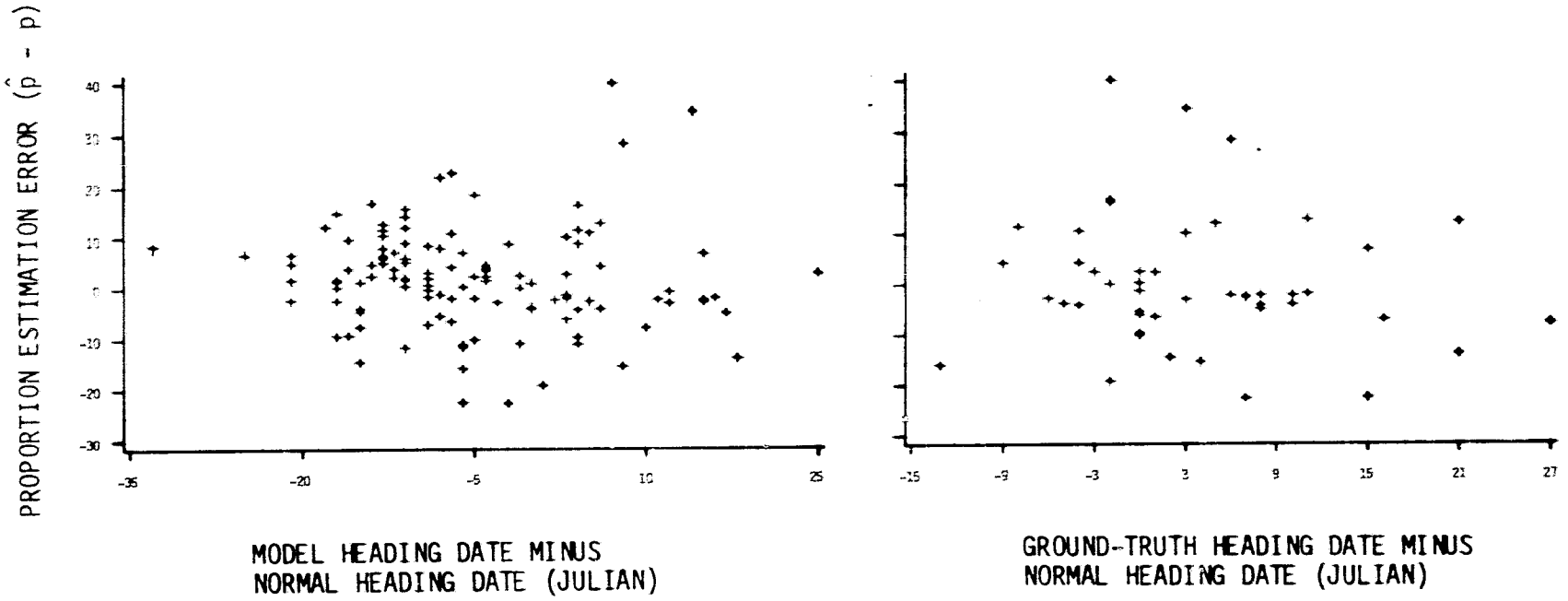
MODEL HEADING DATE MINUS
NORMAL HEADING DATE (JULIAN)

GROUND-TRUTH HEADING DATE MINUS
NORMAL HEADING DATE (JULIAN)

NO DISCERNIBLE RELATIONSHIP WAS FOUND BETWEEN PROPORTION ESTIMATION ERROR AND DEVIATION FROM NORMAL HEADING DATE BY YEAR, STATE, OR APU.

9/28/81

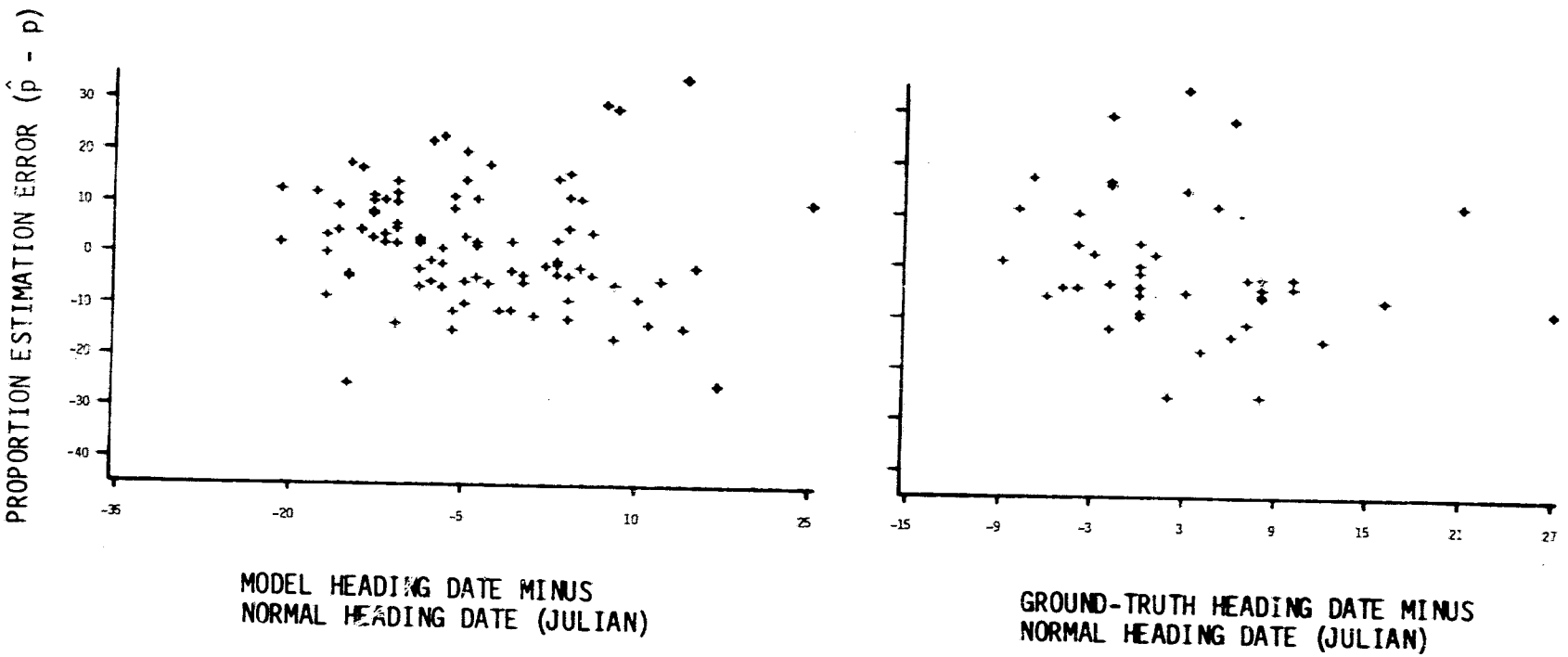
SSG3B ERROR VS. DEVIATION FROM NORMAL HEADING DATE



NO DISCERNIBLE RELATIONSHIP WAS FOUND BETWEEN PROPORTION ESTIMATION ERROR AND DEVIATION FROM NORMAL HEADING DATE BY YEAR, STATE, OR APU.

9/28/81

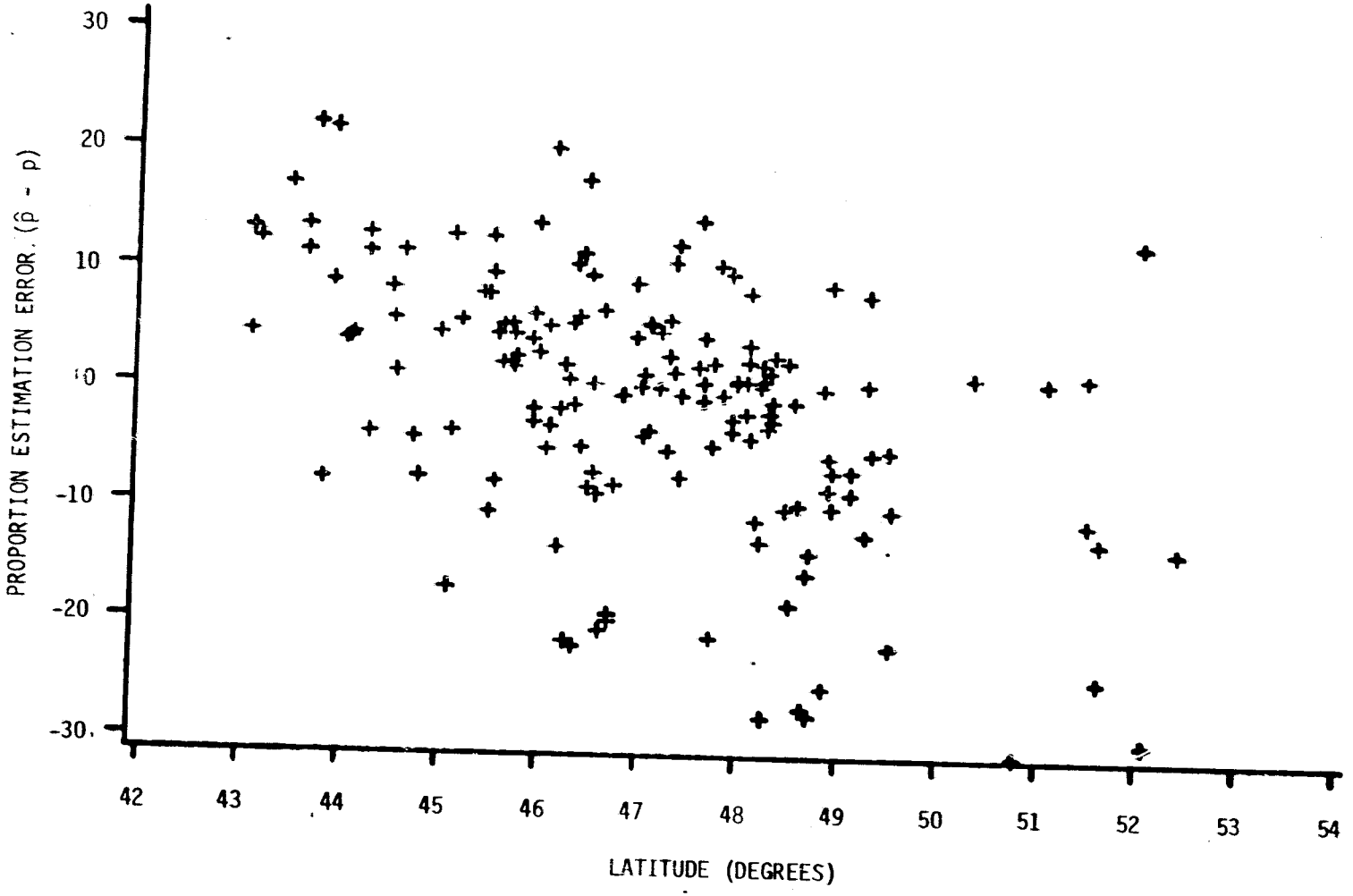
SSG3C ERROR VS. DEVIATION FROM NORMAL HEADING DATE



NO DISCERNIBLE RELATIONSHIP WAS FOUND BETWEEN PROPORTION ESTIMATION ERROR AND DEVIATION FROM NORMAL HEADING DATE BY YEAR, STATE, OR APU.

9/28/81

SSG4 ERROR VERSUS LATITUDE



A TREND IS EVIDENT BETWEEN PROPORTION ESTIMATION ERROR AND LATITUDE, FOR ALL YEARS AND BY YEAR. THIS COULD BE ILLUSTRATING A PROBLEM WITH THE CROP CALENDAR OR SIGNIFICANT TRENDS IN OMISSION AND COMMISSION ERRORS, OR A COMBINATION OF BOTH.

9/28/81

E	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	SEGS.	YEAR(S)	DATE	TEST PERIOD	
								FROM	TO
ITY	SSG4-SPATIAL/COLOR SEQUENCE SSG3B-SEMI-AUTO CAESAR SSG3C-AUTOMATIC CAESAR	AREA ESTIMATION	SUBSYSTEM	U.S./CANADA MN ND MT SK SD	189	1976 - 1979	9/28/81	8/81	9/81

DATA ASSESSMENT

IS OF THIS STUDY CAN BE VIEWED IN TERMS OF CHARACTERISTICS OF THE DATA AND MODELS IN GENERATING SOME OF THE DATA.

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	SEGS.	YEAR(S)	DATE	TEST PERIOD	
									FROM	TO
10	PILOT (SENSITIVITY STUDY)	SSG4-SPATIAL/COLOR SEQUENCE SSG3B-SEMI-AUTO CAESAR SSG3C-AUTOMATIC CAESAR	AREA ESTIMATION	SUBSYSTEM	U.S./CANADA MN ND MT SK SD	189	1976 - 1979	9/28/81	8/81	9/81

ENUMERATOR TASKS AND THEIR SIGNIFICANCE TO SENSITIVITY STUDIES

- o GROUND TRUTH DATA PROBLEMS
  - o SELECTION AND IDENTIFICATION OF SPECIAL FIELDS
    - + SUBJECTIVE FIELD SELECTION
      - - PERHAPS BIASED TO FIELDS WITH EARLY PLANTING DATES SINCE ONLY EMERGED FIELDS ARE OBSERVED
      - - FIELDS THAT ARE SELECTED ARE NOT NECESSARILY REPRESENTATIVE OF THE SEGMENT (NON-RANDOM SAMPLE)
      - - UNDER CURRENT METHODOLOGY THESE PROBLEMS HAVE LARGELY BEEN ELIMINATED
  - o OBSERVATION INTERVAL
    - + EVERY 9-18 DAYS, DEPENDENT ON SATELLITE OVERPASS FREQUENCY
      - - THIS OBSERVATION INTERVAL IS NOT NECESSARILY COINCIDENT WITH DISCRETE CROP BIOSTAGE

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	SEGS.	YEAR(S)	DATE	TEST PERIOD	
									FROM	TO
10	PILOT (SENSITIVITY STUDY)	SSG4-SPATIAL/COLOR SEQUENCE SSG3B-SEMI-AUTO CAESAR SSG3C-AUTOMATIC CAESAR	AREA ESTIMATION	SUBSYSTEM	U.S./CANADA MN ND MT SK SD	189	1976 - 1979	9/28/81	8/81	9/81
SPRING SMALL GRAINS PLANTING DATE DISTRIBUTION MODEL										

- GROUND TRUTH PLANTING DATES AFFECT MODEL FUNCTION
  - ESTIMATION OF THE START OF PLANTING IS DEPENDENT UPON:
    - + THE CRITICAL VALUE OF ACCUMULATED GROWING DEGREE DAYS THAT IS EMPIRICALLY DERIVED BASED ON OBSERVED PLANTING DATES FOR SPECIAL FIELDS
    - + THE CRITICAL VALUE OF THE SPONGE PRECIPITATION VARIABLE THAT IS EMPIRICALLY DERIVED BASED ON OBSERVED PLANTING DATES FOR SPECIAL FIELDS
  - ESTIMATION OF THE DURATION OF PLANTING
    - + DERIVED FROM OBSERVED FINAL PLANTING DATE FOR SPECIAL FIELDS AND THE ESTIMATED START OF PLANTING

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	SEGS.	YEAR(S)	DATE	TEST PERIOD	
									FROM	TO
10	PILOT (SENSITIVITY STUDY)	SSG4-SPATIAL/COLOR SEQUENCE SSG3B-SEMI-AUTO CAESAR SSG3C-AUTOMATIC CAESAR	AREA ESTIMATION	SUBSYSTEM	U.S./CANADA MN ND MT SK SD	189	1976 - 1979	9/28/81	8/81	9/81
AGROMETEOROLOGICAL CROP PHENOLOGY MODEL FOR SPRING WHEAT										

- MODEL REQUIRES AN ACCURATE ESTIMATE OF THE BEGINNING OF CROP DEVELOPMENT
  - FEYERHERM PLANTING DATE MODEL WAS EXTENDED TO SPRING SMALL GRAINS, PERHAPS ERRONEOUSLY
- MODEL COMPONENTS
  - THE USE OF ESTIMATES TO DERIVE ESTIMATES (CHAINING ESTIMATES) IN MANY OF THE MODEL COMPONENTS INTRODUCES ERROR INTO THE DETERMINATION OF CROP STAGE

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	SEGS.	YEAR(S)	DATE	TEST PERIOD	
									FROM	TO
10	PILOT (SENSITIVITY STUDY)	SSG4-SPATIAL/COLOR SEQUENCE SSG3B-SEMI-AUTO CAESAR SSG3C-AUTOMATIC CAESAR	AREA ESTIMATION	SUBSYSTEM	U.S./CANADA MN ND MT SK SD	189	1976 - 1979	9/28/81	8/81	9/81

CONCLUSION

- LACK OF DISCERNABLE RELATIONSHIPS BETWEEN PROPORTION ESTIMATION ERROR FOR EACH OF THE PROCEDURES AND ALL OF THE VARIABLES CAN IMPLY:
  - THERE IS LITTLE OR NO RELATIONSHIP BETWEEN THE VARIABLES
  - IMPRECISION IN THE INDEPENDENT VARIABLES EXAMINED HAS DISGUISED RELATIONSHIPS
  - THE VARIABLES DO NOT REPRESENT THE PHENOMENA THAT THEY DESCRIBE

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	SEGS.	YEAR(S)	DATE	TEST PERIOD	
									FROM	TO
10	PILOT (SENSITIVITY STUDY)	SSG4-SPATIAL/COLOR SEQUENCE SSG3B-SEMI-AUTO CAESAR SSG3C-AUTOMATIC CAESAR	AREA ESTIMATION	SUBSYSTEM	U.S./CANADA MN ND MT SK SD	189	1976 - 1979	9/28/81	8/81	9/81
RECOMMENDATION										

- DEPENDENT VARIABLE
  - THE EXPRESSION OF PROPORTION ESTIMATION ERROR AS A SINGLE QUANTITY MASKS EACH OF ITS COMPONENTS (OMISSION AND COMMISSION ERROR). FUTURE ERROR MODELING DEVELOPMENT WILL UTILIZE COMMISSION AND OMISSION ERROR AS INDEPENDENT QUANTITIES.

CHARACTERIZATION OF SSG'S PROPORTION ESTIMATION ERRORS

D. T. REGISTER
9/28/81

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	SEGS.	YEAR(S)	DATE	TEST PERIOD	
									FROM	TO
12	PILOT	SSG2 - BASELINE SSG3b - SEMI AUTO. CAESAR SSG3C - AUTOMATIC CAESAR SSG4 - SPATIAL/COLOR SEQUENCE	AREA ESTIMATION	SUBSYSTEM	US/CANADA	189	76-79	9/28/81	8/81	9/81
CHARACTERIZATION OF SSG'S PROPORTION ESTIMATION ERRORS										

- OBJECTIVE

  DETERMINE CAUSE OF MAJOR SOURCES OF ERROR

- THREE EVALUATION APPROACHES WILL BE USED

- FIRST APPROACH

  --EXAMINE THE SEGMENTS WITH THE LARGEST ERRORS FOR EACH PROCEDURE

- LIMITATIONS

  --DUE TO TIME CONSTRAINTS, ONLY 20 SEGMENTS WERE EXAMINED FOR EACH PROCEDURE

  --NOT ABLE TO QUANTIFY THE EFFECTS OF THE OBSERVED CAUSES FOR ALL SEGMENTS

- ADVANTAGES

  --PROVIDES QUICK, EFFICIENT FEEDBACK ON MAJOR SOURCES OF ERROR

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	SEGS.	YEAR(S)	DATE	TEST PERIOD	
									FROM	TO
12	PILOT	SSG2 - BASELINE SSG3b - SEMI AUTO. CAESAR SSG3C - AUTOMATIC CAESAR SSG4 - SPATIAL/COLOR SEQUENCE	AREA ESTIMATION	SUBSYSTEM	US/CANADA	189	76-79	9/28/81	8/81	9/81
CHARACTERIZATION OF SSG'S PROPORTION ESTIMATION ERRORS										

- RESULTS - SSG4

1. SOFTWARE IMPLEMENTATION ERRORS

SELECTED CONSECUTIVE DATE ACOUISITIONS

SEGMENT	YEAR	STATE	ERROR
1616	1977	ND	-25.0
1653	1978	ND	-16.6

NUMBER OF FIELDS EXCEEDED SOFTWARE DIMENSION LIMIT

SEGMENT	YEAR	STATE	ERROR
3144	1979	SK	-45.8

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	SEGS.	YEAR(S)	DATE	TEST PERIOD	
									FROM	TO
12	PILOT	SSG2 - BASELINE SSG3b - SEMI AUTO. CAESAR SSG3C - AUTOMATIC CAESAR SSG4 - SPATIAL/COLOR SEQUENCE	AREA ESTIMATION	SUBSYSTEM	US/CANADA	189	76-79	9/28/81	8/81	9/81
CHARACTERIZATION OF SSG'S PROPORTION ESTIMATION ERRORS										

SSG4 RESULTS (CONTINUED)

2. CLERICAL ERRORS

FAILED TO IDENTIFY MISREGISTERED ACQUISITIONS IN DATA BASE.

SEGMENT	YEAR	STATE	ERROR
1515	1977	MN	-19.8
3053	1979	SK	18.3

INCORRECT METEOROLOGICAL TAPE USED

SEGMENT	YEAR	STATE	ERROR
1839	1977	MN	-21.3

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	SEGS.	YEAR(S)	DATE	TEST PERIOD	
									FROM	TO
12	PILOT	SSG2 - BASELINE SSG3b - SEMI AUTO. CAESAR SSG3C - AUTOMATIC CAESAR SSG4 - SPATIAL/COLOR SEQUENCE	AREA ESTIMATION	SUBSYSTEM	US/CANADA	189	76-79	9/28/81	8/81	9/81
CHARACTERIZATION OF SSG'S PROPORTION ESTIMATION ERRORS										

SSG4 RESULTS (CONTINUED)

3. INCORRECT BIOWINDOW DESIGNATION

FIRST ACQUISITION SELECTED WAS IN BIOWINDOW 1

SEGMENT	YEAR	STATE	ERROR
1457	1978	ND	-28.0
1472	1978	ND	-20.0
1544	1978	MT	-27.8
1602	1978	ND	-14.5

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	SEGS.	YEAR(S)	DATE	TEST PERIOD	
									FROM	TO
12	PILOT	SSG2 - BASELINE SSG3b - SEMI AUTO. CAESAR SSG3C - AUTOMATIC CAESAR SSG4 - SPATIAL/COLOR SEQUENCE	AREA ESTIMATION	SUBSYSTEM	US/CANADA	189	76-79	9/28/81	8/81	9/81
CHARACTERIZATION OF SSG'S PROPORTION ESTIMATION ERRORS										

SSG4 RESULTS (CONTINUED)

4. PROCEDURE DEFICIENCIES

LABELING LOGIC IS INAPPROPRIATE WHEN NO BIOWINDOW 4 ACQUISITION IS AVAILABLE

SEGMENT	YEAR	STATE	ERROR
3130	1979	SK	-31.0
3175	1979	SK	-29.5
3185	1978	SK	-29.8

LABELING LOGIC CUTOFF FOR SPECTRAL APPEARANCE 3 WAS INAPPROPRIATE

SEGMENT	YEAR	STATE	ERROR
3083	1978	SK	-22.0

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	SEGS.	YEAR(S)	DATE	TEST PERIOD	
									FROM	TO
12	PILOT	SSG2 - BASELINE SSG3b - SEMI AUTO. CAESAR SSG3C - AUTOMATIC CAESAR SSG4 - SPATIAL/COLOR SEQUENCE	AREA ESTIMATION	SUBSYSTEM	US/CANADA	189	76-79	9/28/81	8/81	9/81
CHARACTERIZATION OF SSG'S PROPORTION ESTIMATION ERRORS										

SSG4 RESULTS (CONTINUED)

5. PROCEDURE DEFICIENCY/CONFUSION CROPS?

COMMISSION ERRORS

SEGMENT	YEAR	STATE	ERROR	CONFUSION CROP
1658	1979	ND	20.1	SUNFLOWERS
1675	1977	SD	13.8	PASTURE, ABANDONED SPRING SMALL GRAINS
1694	1977	SD	21.8	WINTER WHEAT
1800	1977	SD	22.1	PASTURE, CORN
1811	1977	SD	13.3	PASTURE, CORN
1974	1979	ND	17.5	SUNFLOWERS

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	SEGS.	YEAR(S)	DATE	TEST PERIOD	
									FROM	TO
12	PILOT	SSG2 - BASELINE SSG3b - SEMI AUTO. CAESAR SSG3C - AUTOMATIC CAESAR SSG4 - SPATIAL/COLOR SEQUENCE	AREA ESTIMATION	SUBSYSTEM	US/CANADA	189	76-79	9/28/81	8/81	9/81
CHARACTERIZATION OF SSG'S PROPORTION ESTIMATION ERRORS										

- SUMMARY - SSG4

  OF THE 20 LARGEST ERRORS (WITH UGTT'S AVAILABLE)

  --9 ARE EASILY CORRECTABLE

  --4 REQUIRE IMPROVED BIOWINDOW DESIGNATIONS

  --7 REQUIRE ADDITIONAL PROCEDURE DEVELOPMENT

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	SEGS.	YEAR(S)	DATE	TEST PERIOD	
									FROM	TO
12	PILOT	SSG2 - BASELINE SSG3b - SEMI AUTO. CAESAR SSG3C - AUTOMATIC CAESAR SSG4 - SPATIAL/COLOR SEQUENCE	AREA ESTIMATION	SUBSYSTEM	US/CANADA	189	76-79	9/28/8	8/81	9/81
CHARACTERIZATION OF SSG'S PROPORTION ESTIMATION ERRORS										

- RESULTS - SSG3C

  1. CLERICAL ERRORS

     FAILED TO IDENTIFY MISREGISTERED ACQUISITIONS IN DATA BASE.

SEGMENT	YEAR	STATE	ERROR
1619	1977	ND	-19.9

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	SEGS.	YEAR(S)	DATE	TEST PERIOD	
									FROM	TO
12	PILOT	SSG2 - BASELINE SSG3b - SEMI AUTO. CAESAR SSG3C - AUTOMATIC CAESAR SSG4 - SPATIAL/COLOR SEQUENCE	AREA ESTIMATION	SUBSYSTEM	US/CANADA	189	76-79	9/28/81	8/81	9/81
CHARACTERIZATION OF SSG'S PROPORTION ESTIMATION ERRORS										

RESULTS - SSG3C (CONTINUED)

2. BIOWINDOW MODEL ERROR

--NO ESTIMATE SHOULD HAVE BEEN OBTAINED ON 3 OF THE 20 SEGMENTS

--BETTER ESTIMATES ARE POSSIBLE ON THE OTHER 17

SEGMENT	YEAR	STATE	ERROR	ERROR WITH SSG3B CORRECTION
1918	1979	ND	34.4	
1625	1977	ND	32.1	NP
1920	1979	ND	29.3	
1392	1979	ND	28.5	
3050	1979	SK	-27.6	
3185	1978	SK	-26.8	4.4
3163	1978	SK	26.0	NP
1544	1978	MT	-25.6	-14.7
1394	1979	ND	-25.6	- 5.1
1903	1977	ND	23.0	
3169	1978	SK	-22.5	-11.3
1633	1976	ND	21.9	
3130	1979	SK	-21.8	- 5.0
3064	1978	SK	-21.2	-11.4
1614	1976	ND	20.7	18.5
1655	1976	ND	-18.8	NP
1550	1978	MT	17.9	1.3
1619	1978	ND	17.6	
1461	1978	ND	16.9	

NP - NOT PROCESSABLE

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	SEGS.	YEAR(S)	DATE	TEST PERIOD	
									FROM	TO
12	PILOT	SSG2 - BASELINE SSG3b - SEMI AUTO. CAESAR SSG3C - AUTOMATIC CAESAR SSG4 - SPATIAL/COLOR SEQUENCE	AREA ESTIMATION	SUBSYSTEM	US/CANADA	189	76-79	9/28/8	8/81	9/81
CHARACTERIZATION OF SSG'S PROPORTION ESTIMATION ERRORS										

- SUMMARY - SSG3C

  OF THE 20 LARGEST ERRORS

  --1 IS EASILY CORRECTABLE

  --19 REQUIRE IMPROVED BIOWINDOW/PERIOD DESIGNATIONS

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	SEGS.	YEAR(S)	DATE	TEST PERIOD	
									FROM	TO
12	PILOT	SSG2 - BASELINE SSG3b - SEMI AUTO. CAESAR SSG3C - AUTOMATIC CAESAR SSG4 - SPATIAL/COLOR SEQUENCE	AREA ESTIMATION	SUBSYSTEM	US/CANADA	189	76-79	9/28/81	8/81	9/81
CHARACTERIZATION OF SSG'S PROPORTION ESTIMATION ERRORS										

RESULTS - SSG3B

1. SOFTWARE IMPLEMENTATION ERRORS

   INCORRECT SPECIFICATION OF MINIMUM DATA REQUIREMENTS

SEGMENT	YEAR	STATE	ERROR
1948	1978	MT	37.1

2. CLERICAL ERRORS

   FAILED TO IDENTIFY MISREGISTERED ACQUISITIONS

SEGMENT	YEAR	STATE	ERROR
1619	1978	ND	17.6

3. INCORRECT GREEN NUMBERS

   CAUSE UNDER INVESTIGATION

SEGMENT	YEAR	STATE	ERROR
3093	1979	SK	40.3

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	SEGS.	YEAR(S)	DATE	TEST PERIOD	
									FROM	TO
12	PILOT	SSG2 - BASELINE SSG3b - SEMI AUTO. CAESAR SSG3C - AUTOMATIC CAESAR SSG4 - SPATIAL/COLOR SEQUENCE	AREA ESTIMATION	SUBSYSTEM	US/CANADA	189	76-79	9/28/81	8/81	9/81
CHARACTERIZATION OF SSG'S PROPORTION ESTIMATION ERRORS										

RESULTS SSG3B (CONTINUED)

4. BIOWINDOW DESIGNATION ERROR

INCORRECT ACQUISITION SELECTION

SEGMENT	YEAR	STATE	ERROR
1920	1979	ND	40.1
1918	1979	ND	34.4
3050	1979	SK	29.0
1392	1979	ND	28.5
1556	1977	MT	24.4
1903	1977	ND	23.0
1924	1978	ND	-22.7
1457	1978	ND	-22.6
1524	1976	MN	22.3
1633	1976	ND	21.9
1461	1979	ND	20.0
1825	1978	MN	-19.4
1614	1976	ND	18.5
1807	1977	SD	-17.4
1461	1978	ND	16.9
1514	1978	MN	16.3
1909	1978	ND	-15.9

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	SEGS.	YEAR(S)	DATE	TEST PERIOD	
									FROM	TO
12	PILOT	SSG2 - BASELINE SSG3b - SEMI AUTO. CAESAR SSG3C - AUTOMATIC CAESAR SSG4 - SPATIAL/COLOR SEQUENCE	AREA ESTIMATION	SUBSYSTEM	US/CANADA	189	76-79	9/28/81	8/81	9/81
CHARACTERIZATION OF SSG'S PROPORTION ESTIMATION ERRORS										

SUMMARY - SSG3B

OF THE 20 LARGEST ERRORS

--2 ARE EASILY CORRECTABLE

--17 REQUIRE IMPROVED ANALYST VERIFICATION OF BIOWINDOW DESIGNATIONS

--1 UNDETERMINED

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	SEGS.	YEAR(S)	DATE	TEST PERIOD	
									FROM	TO
12	PILOT	SSG2 - BASELINE SSG3b - SEMI AUTO. CAESAR SSG3C - AUTOMATIC CAESAR SSG4 - SPATIAL/COLOR SEQUENCE	AREA ESTIMATION	SUBSYSTEM	US/CANADA	189	76-79	9/28/81	8/81	9/81
CHARACTERIZATION OF SSG'S PROPORTION ESTIMATION ERRORS										

- SECOND APPROACH

  --DETERMINE IF EXPERT KNOWLEDGE OF SSG3C LABELING LOGIC WAS IMPORTANT.

  --ONE OF THE SSG3B ANALYSTS PARTICIPATED IN DEVELOPMENT OF SSG3C LABELING LOGIC.

  --COMPARE SSG3B PERFORMANCE FOR THIS ANALYST VERSUS THE OTHER ANALYSTS.

- RESULTS

  ANALYST WITH SSG3B EXPERTISE PROVIDED MUCH MORE ACCURATE RESULTS

  THAN EITHER SSG3C OR OTHER ANALYSTS WITH LIMITED TRAINING IN SSG3B

ANALYST EFFECT ON VERIFICATION

OF ACQUISITION DESIGNATION

		OVERALL		1976		1977		1978		1979	
		I	II	I	II	I	II	I	II	I	II
SSG3B	$\bar{e}$	0.88	3.86	3.49	5.41	0.65	2.45	-0.10	-0.01	-0.60	14.19
	S_e	6.15	12.88	2.75	7.99	6.59	9.93	7.37	10.72	4.37	19.51
	MAE	5.11	9.89	3.92	6.13	5.03	8.31	6.00	8.58	3.52	18.95
	RME	3.53	13.65	14.04	18.46	2.55	8.51	-0.38	-0.04	-3.74	44.14
	n	36	71	9	11	6	18	18	30	3	12
	$\bar{p}$	24.94	28.27	24.85	29.30	25.47	28.78	26.35	26.04	16.06	32.15
SSG3C	$\bar{e}$	0.80	1.64	4.56	6.69	3.98	0.72	-1.89	-1.28	-0.70	5.74
	S_e	10.07	13.16	5.54	9.03	8.13	11.46	12.39	10.37	4.48	21.75
	MAE	7.63	10.56	6.00	8.45	7.28	9.42	9.23	8.42	3.62	19.60
	RME	3.21	5.80	18.35	22.83	15.63	2.50	-7.17	-4.92	-4.36	17.85

DATA SET = SEGMENTS WITH BOTH SSG3B AND SSG3C ESTIMATES

I - ANALYST WITH SSG3B EXPERTISE

II - EXPERIENCED ANALYSTS WITH LIMITED TRAINING IN SSG3B

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	SEGS.	YEAR(S)	DATE	TEST PERIOD	
									FROM	TO
12	PILOT	SSG2 - BASELINE SSG3b - SEMI AUTO. CAESAR SSG3C - AUTOMATIC CAESAR SSG4 - SPATIAL/COLOR SEQUENCE	AREA ESTIMATION	SUBSYSTEM	US/CANADA	189	76-79	9/28/81	8/81	9/81
CHARACTERIZATION OF SSG'S PROPORTION ESTIMATION ERRORS										

- THIRD APPROACH

  -SSG2 WAS APPLIED TO 30 SEGMENTS ON THE CANDIDATE LIST IN SUPPORT OF A TECHNIQUES DEVELOPMENT ACTIVITY.

  -COMPARE PERFORMANCE OF SSG2 WITH THAT FROM SSG4, SSG3B, AND SSG3C.

  -SINCE SSG2 HAS MORE STEPS REQUIRING ANALYST SKILL, IT PROVIDES AN INDICATION OF THE ROOM FOR IMPROVEMENT IN PERFORMANCE OF SSG4, 3C, AND 3B.

- RESULTS - SSG2

  THE PROPORTION ERRORS FOR SSG2 HAVE A SIGNIFICANTLY LOWER VARIANCE THAN SSG4, SSG3C, OR SSG3B.

  NONE SHOWED SIGNIFICANT BIAS.

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	SEGS.	YEAR(S)	DATE	TEST PERIOD	
									FROM	TO
12	PILOT	SSG2 - BASELINE SSG3b - SEMI AUTO. CAESAR SSG3C - AUTOMATIC CAESAR SSG4 - SPATIAL/COLOR SEQUENCE	AREA ESTIMATION	SUBSYSTEM	US/CANADA	189	76-79	9/28/81	8/81	9/81
CHARACTERIZATION OF SSG'S PROPORTION ESTIMATION ERRORS										

COMPARISON OF SSG2 WITH
SSG4, SSG3C, AND SSG3B ON ALL
PROPORTION ESTIMATES FOR A SET OF 30 SEGMENTS

STATISTIC	SSG4	SSG3C	SSG3B	SSG2
$\bar{e}$	-0.44	-1.27	1.03	2.05
S_e	10.35	12.03	11.10	7.35
MAE	7.96	9.08	7.63	5.91
RME	-1.73	-4.68	4.02	7.70
$\bar{p}$	25.49	27.12	25.62	26.64
n	24	23	25	30

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	SEGS.	YEAR(S)	DATE	TEST PERIOD	
									FROM	TO
12	PILOT	SSG2 - BASELINE SSG3b - SEMI AUTO. CAESAR SSG3C - AUTOMATIC CAESAR SSG4 - SPATIAL/COLOR SEQUENCE	AREA ESTIMATION	SUBSYSTEM	US/CANADA	189	76-79	9/28/8	8/81	9/81
CHARACTERIZATION OF SSG'S PROPORTION ESTIMATION ERRORS										

COMPARISON OF ALL PROCEDURES

ON COMMON SEGMENTS

STATISTIC	SSG4	SSG3C	SSG3B	SSG2
$\bar{e}$	-0.76	-1.25	0.15	1.79
S_e	10.38	12.14	11.94	8.39
MAE	7.98	8.65	7.21	6.68
RME	-2.83	-4.65	0.06	6.53
$\bar{p}$	26.89	26.89	26.89	27.39
n	18	18	18	18

SIGNIFICANCE

- FIRST GENERATION AUTOMATED PROPORTION ESTIMATION PROCEDURES SHOWED LOWER BIAS AND HIGHER VARIANCE THAN PROCEDURES REQUIRING ANALYST SKILL. ONE AUTOMATED PROCEDURE (SSG4) SHOWED COMPARABLE RATES OF PROCESSABILITY.

- MAJOR FACTORS WHICH INFLUENCE PROPORTION ESTIMATION ACCURACY:
  - -- ACQUISITION HISTORY (NUMBER AND TIME OF OCCURRENCE OF LANDSAT DATA COLLECTION)
  - -- DESIGNATION OF CORRECT WINDOW/PERIOD FOR AVAILABLE ACQUISITION

- EFFECTS OF RAINFALL AND TEMPERATURE PATTERNS WERE OBSCURED BY THE MAJOR FACTORS.

- INCREASED EFFICIENCY OF AUTOMATED PROCEDURES PROVIDES A 100-FOLD IMPROVEMENT IN EXPERIMENT DESIGN FLEXIBILITY.

- AUTOMATED PROCEDURES REMOVE ANALYST SUBJECTIVITY AND THEREBY INCREASE THE POWER OF STATISTICAL TESTS AND ABILITY TO QUANTIFY OTHER EFFECTS OF INTEREST.

- ADAPTABILITY OF AUTOMATED PROCEDURES TO USSR AND EXTENSION TO WINTER SMALL GRAINS APPEARS ENCOURAGING.

SAMPLING AND AGGREGATION TECHNOLOGY IN 1981 PHASE OF U.S./CANADA SPING SMALL GRAINS PILOT

1. ACCOMPLISHMENTS IN SSG PILOT
2. SAMPLING TECHNOLOGY
3. BASELINE AGGREGATION TECHNOLOGY

J. T. MALIN
9/28/81

SUMMARY OF SAMPLING AND AGGREGATION ACCOMPLISHMENTS IN U.S./CANADA SPRING SMALL GRAINS PILOT

TECHNOLOGY

- SAMPLING TECHNOLOGY 1976-1979
  - STRATIFIED RANDOM SAMPLING WITH OPTIMAL ALLOCATION TO STRATA
  - UNIVERSAL STRATA (APU'S) BEGINNING IN 1978
  - FURTHER TECHNOLOGY DEVELOPMENT FOR 1980 NOT TESTED IN THIS PILOT

- BASELINE AGGREGATION TECHNOLOGY
  - SFG-1: SINGLE YEAR FULL RESPONSE PROCEDURE AND GROUPED OPTIMAL AGGREGATION TECHNIQUE (GOAT)
  - FIRST LARGE AREA EVALUATION OF GOAT WITH REAL DATA
    - --GOAT STABILIZES AREA AND PRODUCTION ESTIMATES WHERE THERE IS A HIGH RATE OF DATA LOSS, PRODUCING A NET REDUCTION IN VARIANCE
  - AGGREGATION COMPONENT IS OBJECTIVE AND EFFICIENT

TESTS

- 1981
  - GROUPING APPROACH COMPARISON STUDY
    - --WHETHER TO ALLOW GOAT TO FORM GROUPS OF STRATA FROM THE ENTIRE AREA, OR TO RESTRICT GROUPING TO SUBAREAS TO REDUCE POSSIBLE BIAS
  - PRELIMINARY NORTH DAKOTA 1978 AGGREGATION STUDY OF AREA ESTIMATION TECHNOLOGY
    - --CHARACTERISTICS OF LARGE AREA ESTIMATES FROM THREE PROPORTION ESTIMATION PROCEDURES (SSG3B, SSG3C, SSG4), AGGREGATED WITH BASELINE AGGREGATION COMPONENT

LEVEL	TYPE	PROCEDURAL DEVELOPMENT FAMILY TREE	DATE
COMPONENT	SAMPLING		

SINGLE CROP									MULTI-CROP								
SINGLE YEAR VARIANCE CALCULATION			MULTI-YEAR CURRENT VARIANCE CALCULATION			MULTI-YEAR CHANGE VARIANCE CALCULATION			SINGLE YEAR VARIANCE CALCULATION			MULTI-YEAR CURRENT VARIANCE CALCULATION			MULTI-YEAR CHANGE VARIANCE CALCULATION		
INDIRECT	DIRECT		INDIRECT	DIRECT		INDIRECT	DIRECT		INDIRECT	DIRECT		INDIRECT	DIRECT		INDIRECT	DIRECT	
	HIST.	AUTO.		HIST.	AUTO		HIST.	AUTO.		HIST.	AUTO.		HIST.	AUTO		HIST.	AUTO
SSB-1 1978 SAMPLE DESIGN (WHEAT-TY)									MSI-2 1980 MULTICROP SAMPLE DESIGN (C/S)								

9/28/81

TESTS (CONTINUED)

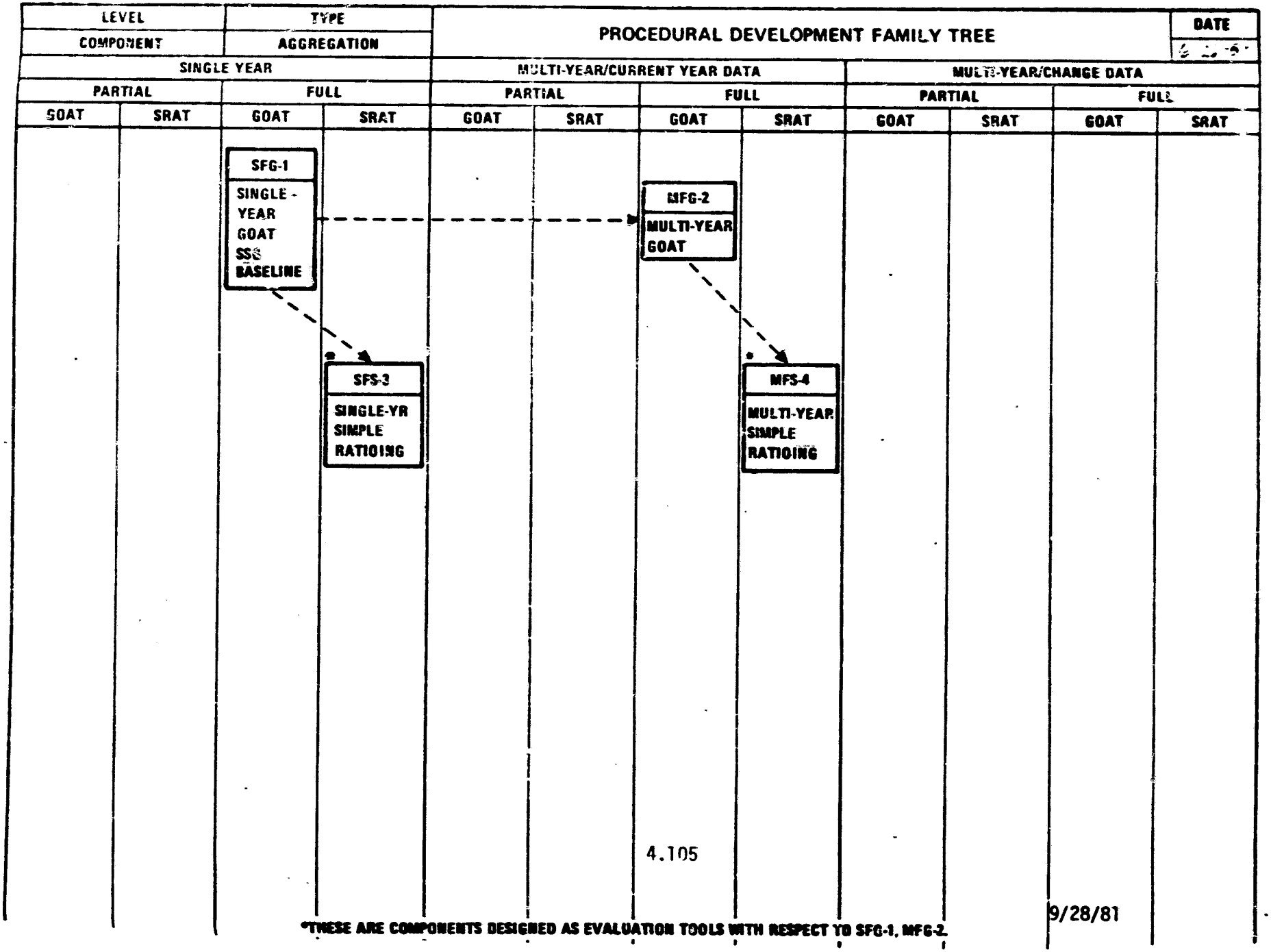
- BONUS: FOUR-STATE AGGREGATION STUDY
  - --CHARACTERISTICS OF LARGE AREA ESTIMATES ON SUBSET OF SEGMENTS WITH GROUND TRUTH, FROM 1976-1979, FROM THREE PROPORTION ESTIMATION PROCEDURES
  - --CHARACTERISTICS OF BASELINE AGGREGATION COMPONENT

- 1982 PLAN
  - FOUR AGGREGATION PROCEDURES COMPARISON STUDY
    - --EVALUATE PERFORMANCE OF MULTIYEAR AGGREGATION AND GROUPED OPTIMAL AGGREGATION SUBCOMPONENTS ON REAL DATA
    - --ESTIMATES OF EFFECTS OF ERROR FROM SAMPLING/PROCESSABILITY, CLASSIFICATION, AND AGGREGATION COMPONENTS
  - NORTH DAKOTA 1978 DEMONSTRATION OF AREA ESTIMATION TECHNOLOGY
    - --FINAL RESULTS FOR FOUR PROPORTION ESTIMATION PROCEDURES (SSG2, SSG3B, SSG3C, SSG4)
    - --ANALYSIS OF SOURCES OF ERROR

PRELIMINARY RESULTS SUMMARY

- GROUPING APPROACH COMPARISON STUDY
  - RESTRICTED GROUPING CAN REDUCE BIAS
  - RESTRICTED GROUPING IS RECOMMENDED IF ALL THESE CONDITIONS ARE MET:
    - --THERE IS A REASONABLE BASIS FOR BREAKING AN AREA INTO SUBAREAS THAT ARE EXPECTED TO BEHAVE DIFFERENTLY IN THE TARGET YEAR;
    - --SPARSE DATA ARE EXPECTED IN SOME STRATA; AND
    - --RATIOS BETWEEN STRATA ARE RELATIVELY STABLE ACROSS PREVIOUS YEARS

LEVEL	TYPE	PROCEDURAL DEVELOPMENT FAMILY TREE	DATE
COMPONENT	AGGREGATION		



*THESE ARE COMPONENTS DESIGNED AS EVALUATION TOOLS WITH RESPECT TO SFG-1, MFG-2.

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PRELIMINARY RESULTS SUMMARY (CONTINUED)

- AGGREGATION STUDIES
  - THE PERFORMANCES OF THE THREE LARGE AREA ESTIMATION SYSTEMS ARE:
    --EQUALLY GOOD IN 1977 AND 1978.
    --EQUALLY BAD IN 1976 (LARGE BIAS) AND 1979 (LARGE C.V. AND/OR LARGE BIAS)
  - THE BASELINE AGGREGATION SYSTEM CAN PRODUCE ACCURATE LARGE AREA ESTIMATES USING SURPRISINGLY FEW SEGMENT PROPORTIONS, PROVIDED THESE PROPORTIONS ARE THEMSELVES ACCURATE (GROUND TRUTH PROPORTIONS)
  - THE RESULTS INDICATE THAT PROCESSABILITY, RATHER THAN CLASSIFICATION VARIANCE, IS THE FACTOR STRONGLY AFFECTING LARGE AREA ESTIMATE VARIANCE
  - THE ACCURACIES OF THE LARGE AREA ESTIMATES ALONE PROVIDE NO BASIS FOR CHOOSING A 'BEST' PROPORTION ESTIMATION PROCEDURE

SAMPLING TECHNOLOGY

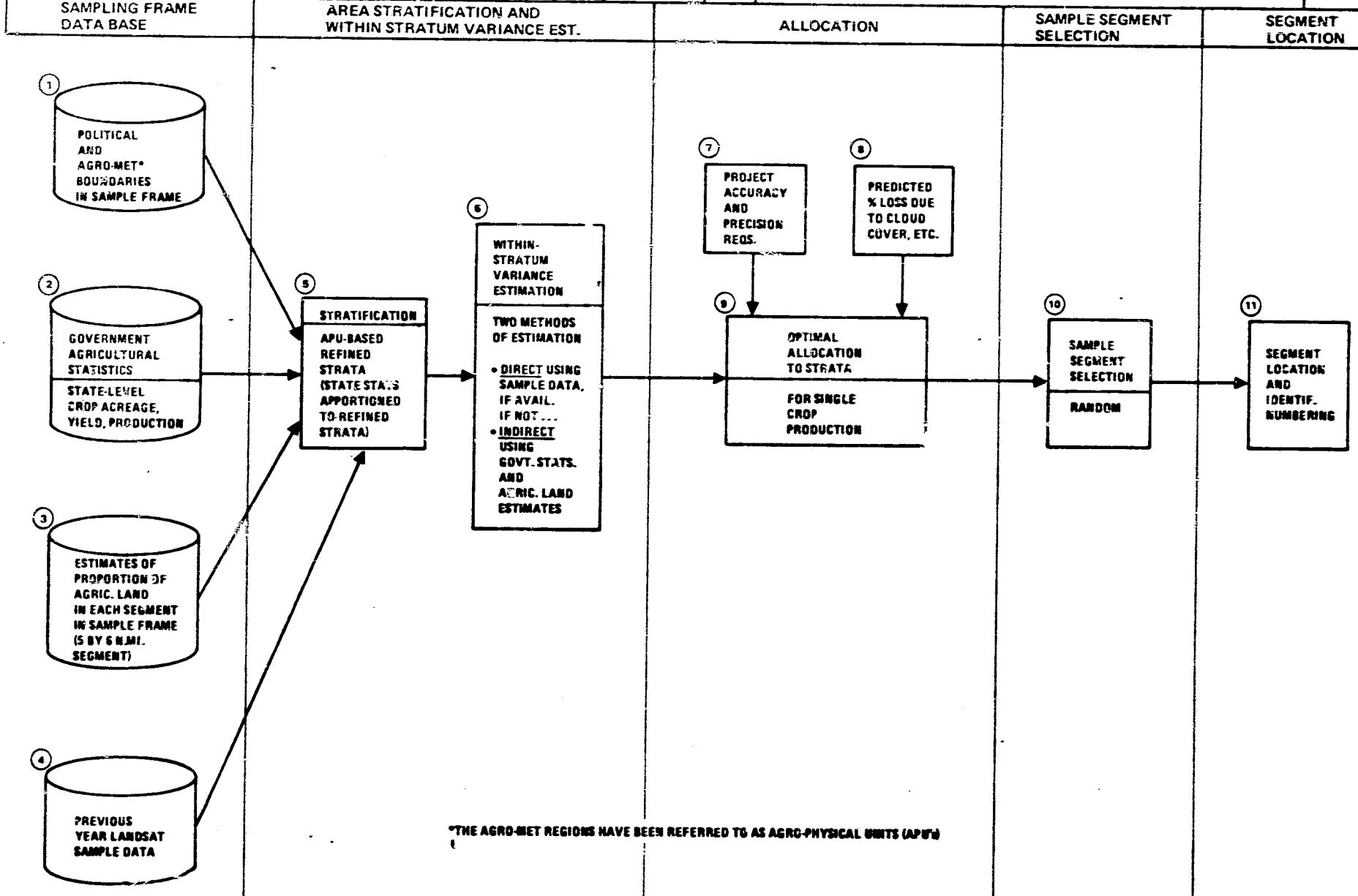
PROCEDURES

- STRATIFIED RANDOM SAMPLING, USING OPTIMUM "NEYMAN" ALLOCATION ACCOUNTING FOR SIZE AND VARIABILITY WITHIN STRATA
  - 1976 AND 1977 POLITICAL BOUNDARIES USED TO DEFINE STRATA
  - 1978 AND 1979 "UNIVERSAL STRATA" ("AGROPHYSICAL UNITS"--APU'S) DEVELOPED TO BE RELATIVELY HOMOGENEOUS WITH RESPECT TO VARIABLES RELATED TO AREA AND PRODUCTION (SSB1)
  - APU'S USED AS STRATA FOR AGGREGATION FOR ALL FOUR YEARS IN THE PILOT

RESOURCE REQUIREMENTS

- SUBSTANTIAL INITIAL START-UP COSTS (SAMPLING FRAME DATA BASE AND STRATIFICATION)
- ANNUAL PERIODIC COSTS SMALL (<20 SEC CPU FOR ALL SOFTWARE)
  MAJOR COST IS LOCATION OF SEGMENTS (ABOUT 4 HOURS EACH FOR NEW SEGMENTS ONLY)

LEVEL	TYPE	CODE	REGION	YEAR	RESP.	S-VAR	NO.	VAR	PROCEDURE NAME	DATE
COMPONENT	SAMPLING		USGP	S	S	B	1		1978 SINGLE CROP SAMPLE DESIGN (WHEAT TY)	4/24/81



*THE AGRO-MET REGIONS HAVE BEEN REFERRED TO AS AGRO-PHYSICAL UNITS (APU's)

9/28/81

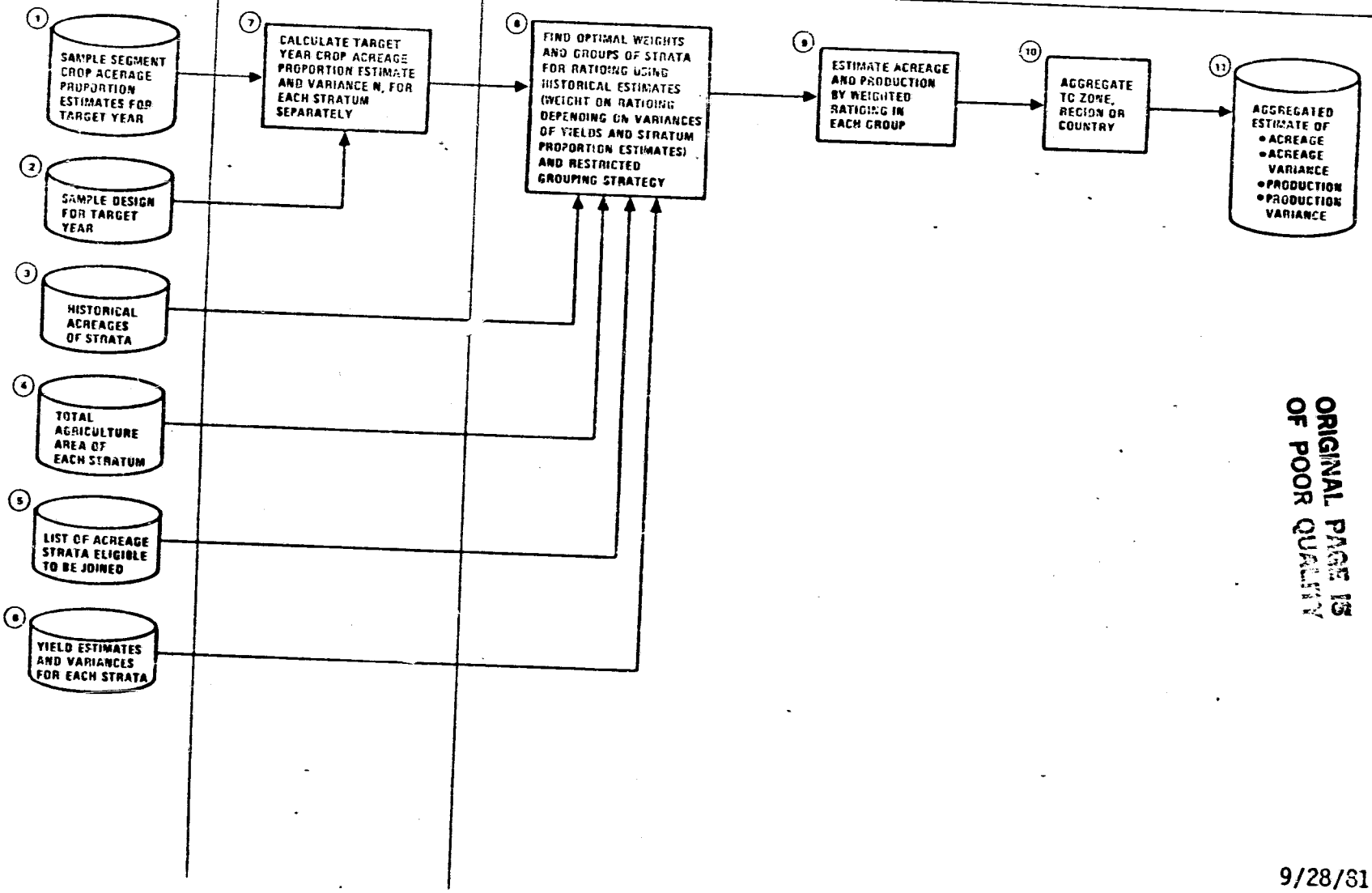
BASELINE AGGREGATION TECHNOLOGY (SFG-1)

SINGLE YEAR FULL RESPONSE PROCEDURE AND GROUPED OPTIMAL AGGREGATION TECHNIQUE

PROCEDURES

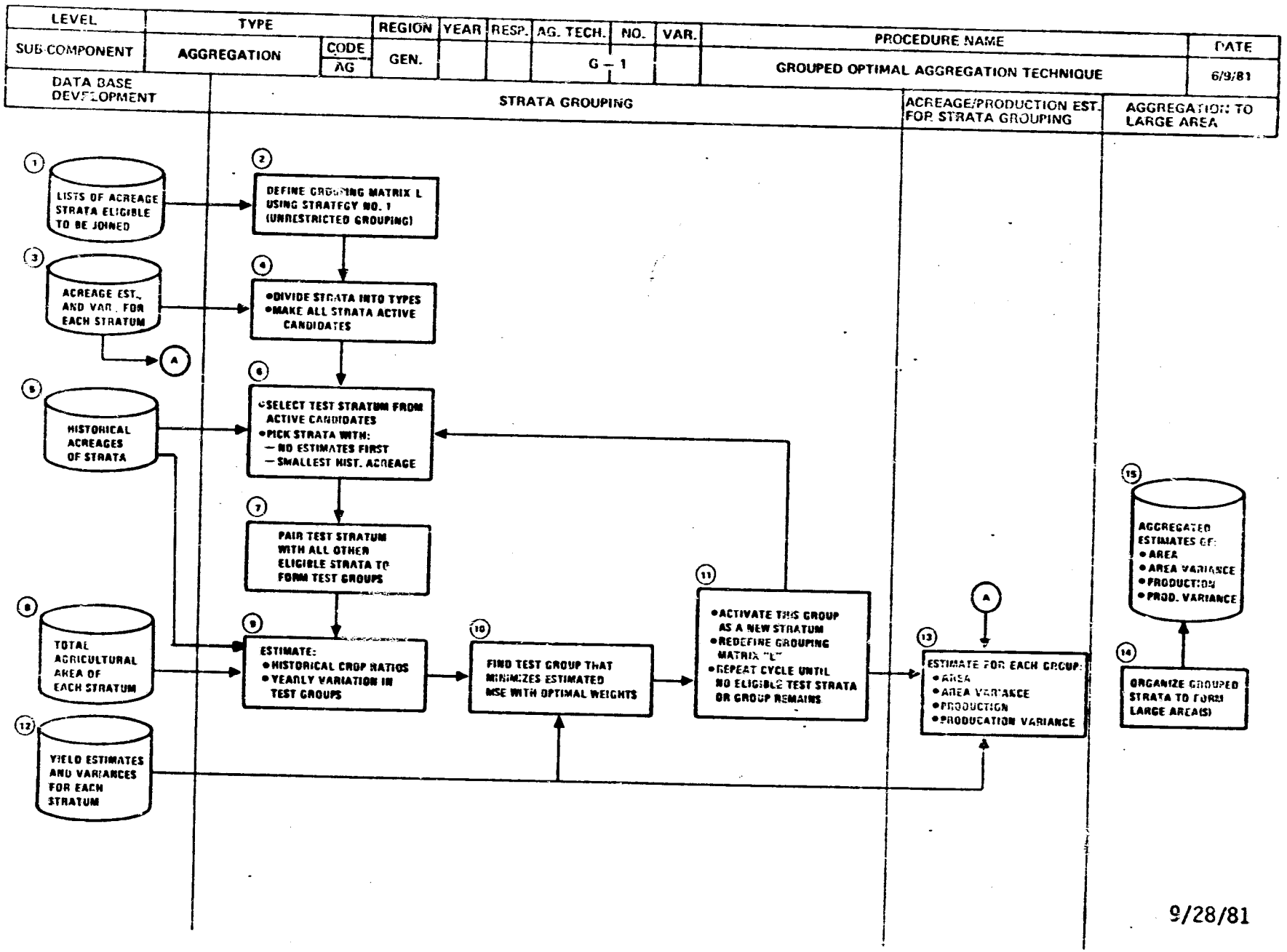
- SINGLE YEAR FULL RESPONSE AGGREGATION TO STRATUM LEVEL IS UNCHANGED. AGGREGATION COMPONENT WITH MULTIYEAR AGGREGATION TO STRATUM LEVEL WILL BE TESTED IN 1982.
- GOAT AGGREGATION TO ZONE (E.G., STATE) AND UP HAS DESIRABLE NEW FEATURES:
  - STABILIZES AREA (AND PRODUCTION) ESTIMATES IN REGIONS WHERE THERE IS A HIGH RATE OF DATA LOSS OR NECESSITY FOR SMALL SAMPLE SIZE.
  - MAKES BEST POSSIBLE USE OF HISTORICAL RELATION BETWEEN STRATA TO REDUCE VARIANCE (E.G., STRATUM I CONSISTENTLY HAS HALF AS MUCH SPRING SMALL GRAINS AREA AS STRATUM II; SO RATIO ESTIMATE OF STRATUM I IS HALF OF DIRECT ESTIMATE OF STRATUM II THIS YEAR.)
  - RATIOS FOR EVERY STRATUM TO OPTIMALLY REDUCE VARIANCE, RATHER THAN JUST FOR STRATA WITH SPARSE SEGMENT ESTIMATES (AS WAS DONE PREVIOUSLY).
  - EACH STRATUM ESTIMATE IS A WEIGHTED SUM OF DIRECT AND RATIO ESTIMATES.
  - WEIGHTS ARE CHOSEN TO MINIMIZE VARIANCE (BY TAKING ADVANTAGE OF THE RELATIVE STABILITY OF THE DIRECT AND RATIO ESTIMATES).
  - CHOOSESOPTIMAL GROUP OF STRATA OVER WHICH TO RATIO, RATHER THAN USE ARBITRARY POLITICAL ZONES (AS WAS DONE PREVIOUSLY).
- BASELINE AGGREGATION IS OBJECTIVE AND AUTOMATED.
- BASELINE AGGREGATION IS EFFICIENT.
  - START-UP COSTS ARE MINIMAL (ALL SIGNIFICANT DATA BASES ARE OUTPUTS OR BY-PRODUCTS OF SAMPLING OR PROPORTION ESTIMATION).
  - PERIODIC OPERATIONAL AGGREGATION CAN BE PERFORMED BY ONE PERSON IN LESS THAN 5 HOURS WITH LESS THAN 15 SEC CPU.

LEVEL	TYPE		REGION	YEAR	RESP.	AG. TECH.	NO.	VAR.	PROCEDURE NAME	DATE
COMPONENT	AGGREGATION	CODE	SSG	S	F	G - 1		A	SINGLE YEAR – GOAT (SSG BASELINE)	6/9/81
DATA BASE DEVELOPMENT	SINGLE YEAR AGGREGATION OF ACREAGE PER STRATUM	AG							GOAT AGGREGATION OF ACREAGE AND PRODUCTION TO ZONE, REGION, COUNTRY	



9/28/81

LEVEL	TYPE		REGION	YEAR	RESP.	AG. TECH.	NO.	VAR.	PROCEDURE NAME	DATE
SUB-COMPONENT	AGGREGATION	CODE AG	GEN.			G – 1			GROUPED OPTIMAL AGGREGATION TECHNIQUE	6/9/81



9/28/81

FY81 U.S./CANADA SPRING SMALL GRAINS PILOT EXPERIMENT

Recommendations/Research Directions in Sampling and Aggregation

- o Improve efficiency of aggregation technology.
  - oo Automate the selection and preparation of segment proportion data for input to the stratum-level aggregation routine.
  - oo Automate the preparation of (government) historical data for input to the large area aggregation routine.

- o Improve technical aspects of the aggregation technology.
  - oo Extend aggregation technologies to adjust for sampling bias such as that caused by systematic segment-level proportion estimation inaccuracy or systematic patterns of non-processability (or any other factor causing unequal sampling probablities within a stratum).

  - oo Develop an area change estimation methodology for use in regions with stable historical crop acreages and/or uniform cropping levels within strata.

  - oo Test the multi-year and GOAT aggregation technologies in both real and simulated environments to determine their strengths and weaknesses relative to other candidate aggregation technologies.

  - oo Evaluate via simulation the effects of non-procedural biases (such as cloud cover) on large area estimation.

  - oo Study the effect of poor or scarce historical data on the efficiency of the GOAT.

  - oo Develop an improved capability to aggregate areas of specific crops given only crop group proportion estimates in some areas (partial response model).

U.S./CANADA SSG PILOT EXPERIMENT

SAMPLING AND AGGREGATION

GROUPING APPROACH COMPARISON STUDY

T. BAKER
9/28/81

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TEST NO.	TEST TYPE	COMP PROCEDURE/MODE	PROC. TYPE	TEST LEVEL	TEST REGION	DATA SET		DATE	TEST PERIOD	
						SEGS.	ACQS.		FROM	TO
13	DEVELOP-MENT	COMPARISON TEST OF SUBCOMPONENTS G-1 G-1A	AGGREGATION	SUB-COMPONENT	MN ND MT SD	1977 177			5/7	8/7/81

TEST TITLE: US/CAN SSG PILOT - SAMPLING AND AGGREGATION - GROUPING APPROACH COMPARISON STUDY

- OBJECTIVE: DETERMINE WHETHER GROUPS OF STRATA FORMED BY THE GOAT FOR RATIOING SHOULD BE RESTRICTED TO LIE WITHIN INDEPENDENTLY DEFINED AND LOGICALLY CONSISTENT GEOGRAPHIC BOUNDARIES OR BE ALLOWED (AS DESIGNED) TO FORM GROUPS EMPLOYING THE PROGRAMMED MATHEMATICAL CRITERIA ONLY.

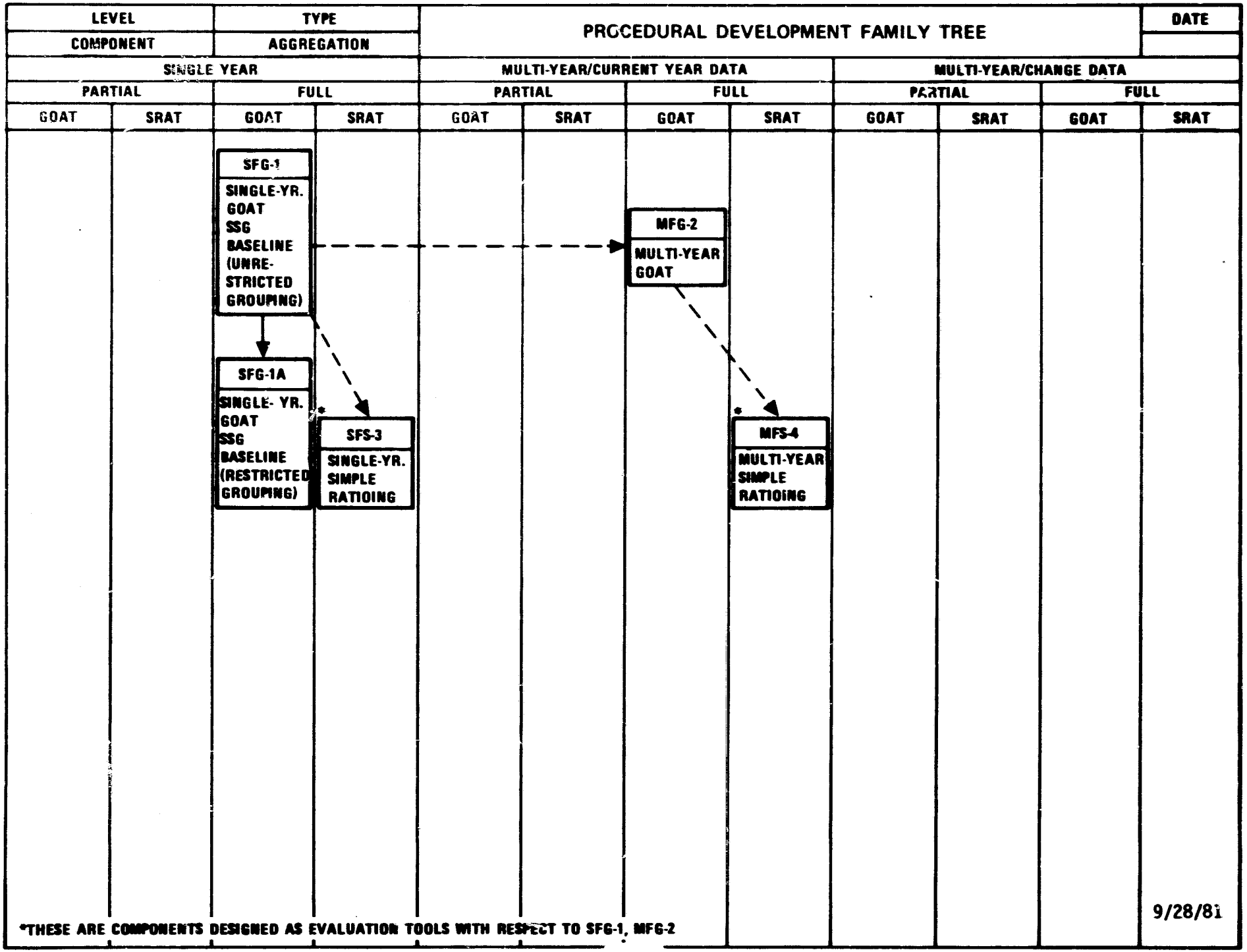
- SCOPE: EVALUATIONS OF TWO ALTERNATIVE IMPLEMENTATIONS OF THE GROUPED OPTIMAL AGGREGATION TECHNIQUE WERE PERFORMED VIA AGGREGATIONS OF ALL 1977 CAMS SEGMENT-LEVEL SSG PROPORTION ESTIMATES FROM MN, MT, ND, SD TO THE STATE AND 4-STATE LEVELS.

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	DATA SET		DATE	TEST PERIOD	
						SEGS.	ACQS.		FROM	TO
	DEVELOP-MENT	COMPARISON TEST OF SUBCOMPONENTS G-1 G-1A	AGGREGATION	SUB-COMPONENT	MN ND MT SD	1977 177			5/7	8/7/81

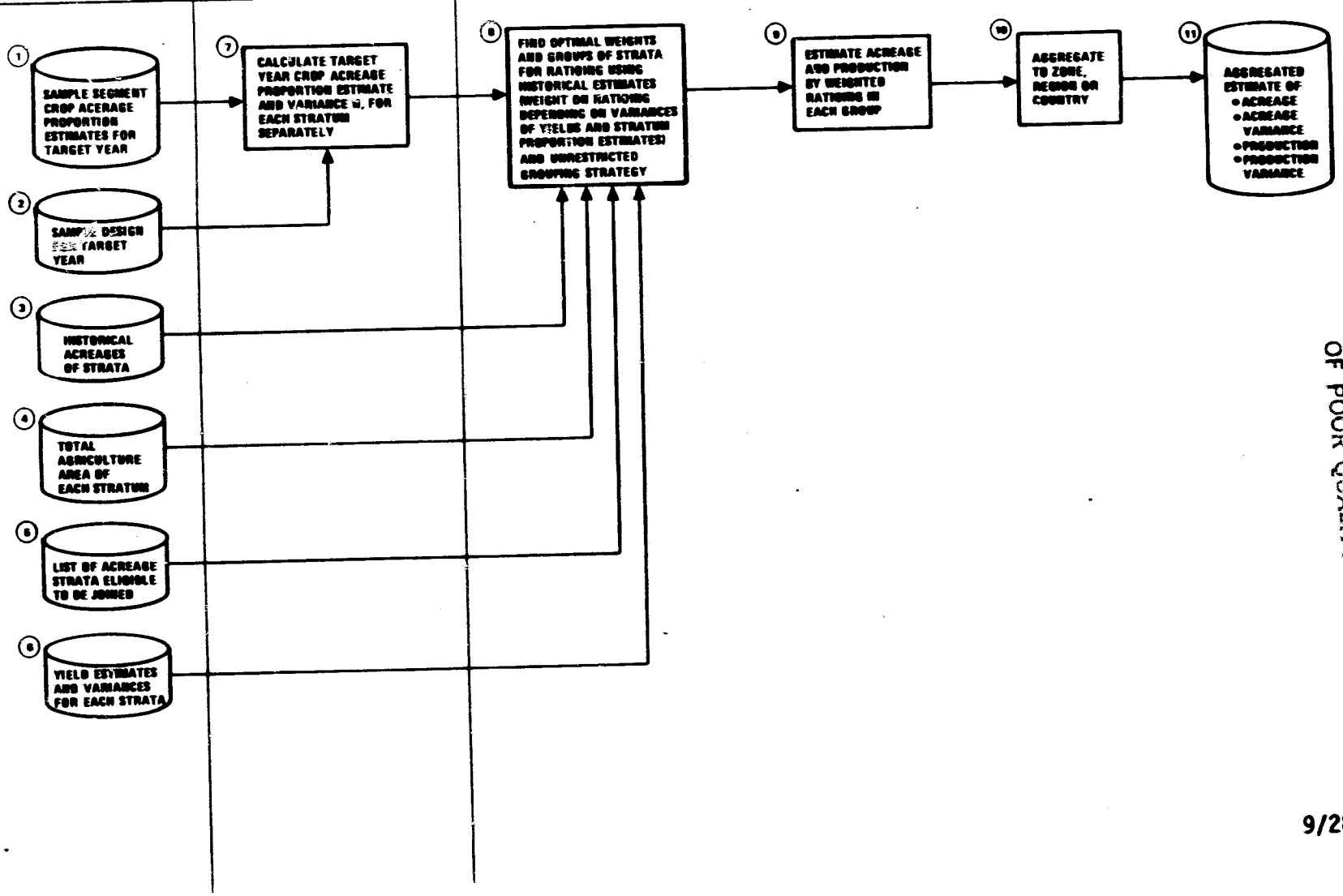
TEST TITLE: US/CAN SSG PILOT - SAMPLING AND AGGREGATION - GROUPING APPROACH COMPARISON STUDY

- BACKGROUND: THE CRITERIA FOR THE FORMATION OF RATIOING GROUPS IN THE GOAT IS ENTIRELY MATHEMATICAL; HENCE, TWO STRATA, WHICH ARE ONLY REMOTELY ASSOCIATED (GEOGRAPHICALLY, METEOROLOGICALLY, ETC.) MAY SOMETIMES BE ADMITTED TO THE SAME RATIOING GROUP BECAUSE OF 'SIMILAR' CROP ACREAGE HISTORIES. THE EXPECTED RESULT OF THIS PHENOMENA IS (POSSIBLY) AN UNNECESSARILY LARGE BIAS IN THE AGGREGATED CROP ACREAGE ESTIMATE DUE TO THE UNWIELDY GEOGRAPHIC EXTENT OF RATIOING GROUPS.

  ANY EFFORT TO OVERCOME THIS DIFFICULTY BY LIMITING THE GEOGRAPHIC EXTENT OF GROUPS WILL RESULT IN AN AGGREGATED CROP ACREAGE ESTIMATE WITH A LARGER (ESTIMATED) MEAN SQUARE ERROR THAN THAT OBTAINABLE IF GROUP FORMATION IS UNRESTRICTED.

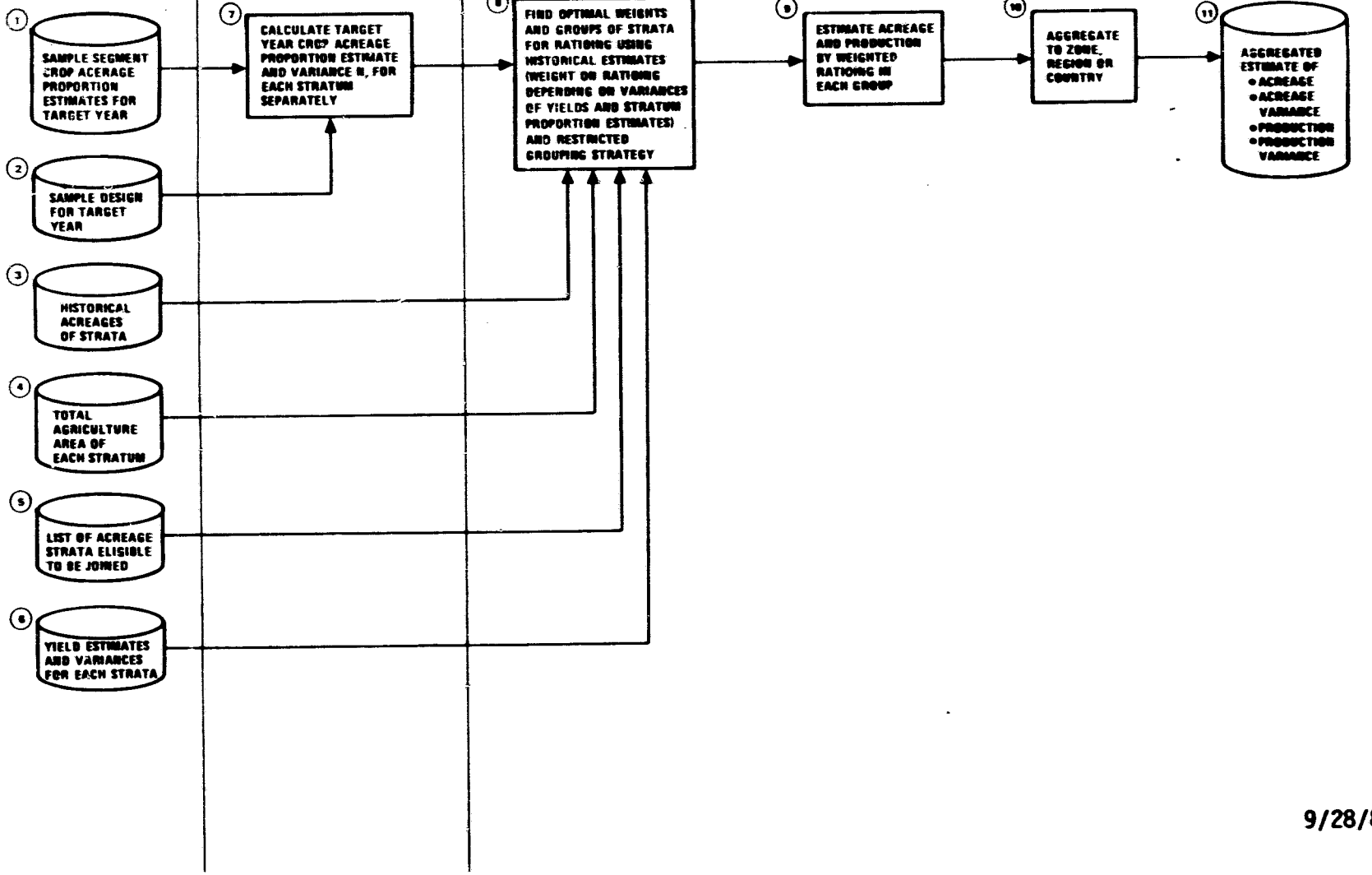

LEVEL
COMPONENT
TYPE
AGGREGATION
PROCEDURAL DEVELOPMENT FAMILY TREE
DATE
SINGLE YEAR
MULTI-YEAR/CURRENT YEAR DATA
MULTI-YEAR/CHANGE DATA
PARTIAL
FULL
PARTIAL
FULL
PARTIAL
FULL
GOAT
SRAT
GOAT
SRAT
GOAT
SRAT
GOAT
SRAT
GOAT
SRAT
GOAT
SRAT
SFG-1
SINGLE-YR. GOAT SSG BASELINE (UNRE-STRICTED GROUPING)
SFG-1A
SINGLE- YR. GOAT SSG BASELINE (RESTRICTED GROUPING)
SFS-3
SINGLE-YR. SIMPLE RATIOING
MFG-2
MULTI-YEAR GOAT
MFS-4
MULTI-YEAR SIMPLE RATIOING
9/28/81
*THESE ARE COMPONENTS DESIGNED AS EVALUATION TOOLS WITH RESPECT TO SFG-1, MFG-2

LEVEL	TYPE		REGION	YEAR	RESP.	AG. TECH.	NO.	VAR.	PROCEDURE NAME	DATE
COMPONENT	AGGREGATION	CODE AG	SSG	S	F	G – 1			SINGLE YEAR – GOAT (SSG BASELINE)	6/9/81
DATA BASE DEVELOPMENT	SINGLE YEAR AGGREGATION OF ACREAGE PER STRATUM		GOAT AGGREGATION OF ACREAGE AND PRODUCTION TO ZONE, REGION, COUNTRY							



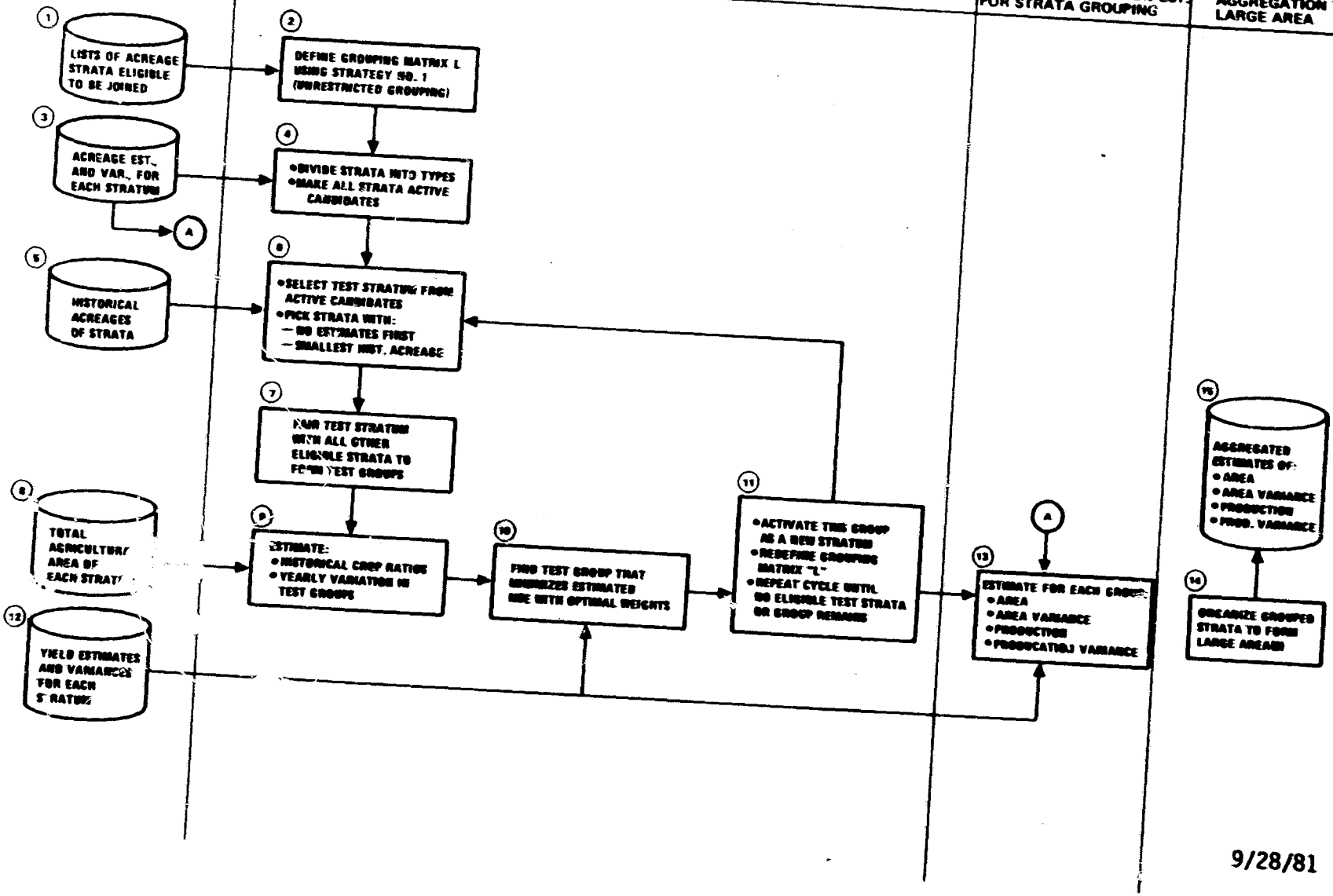
9/28/81

LEVEL	TYPE		REGION	YEAR	RESP.	AG. TECH.	NO.	VAR.	PROCEDURE NAME	DATE
COMPONENT	AGGREGATION	CODE AG	SSG	S	F	G – 1		A	SINGLE YEAR – GOAT (SSG BASELINE)	6/9/81
DATA BASE DEVELOPMENT	SINGLE YEAR AGGREGATION OF ACREAGE PER STRATUM		GOAT AGGREGATION OF ACREAGE AND PRODUCTION TO ZONE, REGION, COUNTRY							



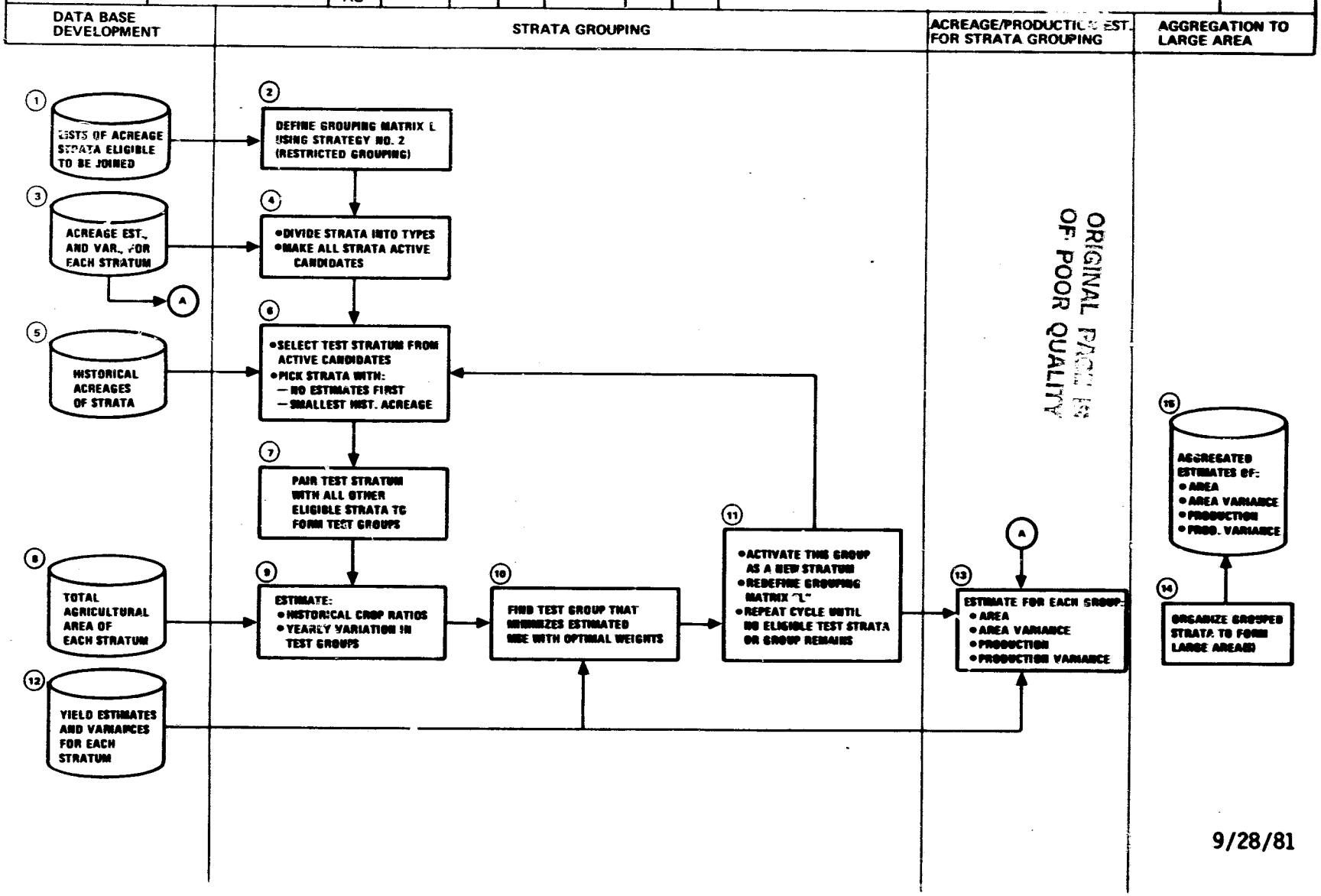
9/28/81

LEVEL	TYPE		REGION	YEAR	RESP.	AG. TECH.	NO.	VAR.	PROCEDURE NAME	DATE
SUB-COMPONENT	AGGREGATION	CODE AG	GEN.			G – 1			GROUPED OPTIMAL AGGREGATION TECHNIQUE	6/9/81
DATA BASE DEVELOPMENT	STRATA GROUPING								ACREAGE/PRODUCTION EST. FOR STRATA GROUPING	AGGREGATION TO LARGE AREA



9/28/81

LEVEL	TYPE		REGION	YEAR	RESP.	AG. TECH.	NO.	VAR.	PROCEDURE NAME	DATE
SUB-COMPONENT	AGGREGATION	CODE AG	GEN.			G	1	A	GROUPED OPTIMAL AGGREGATION TECHNIQUE	6/9/81

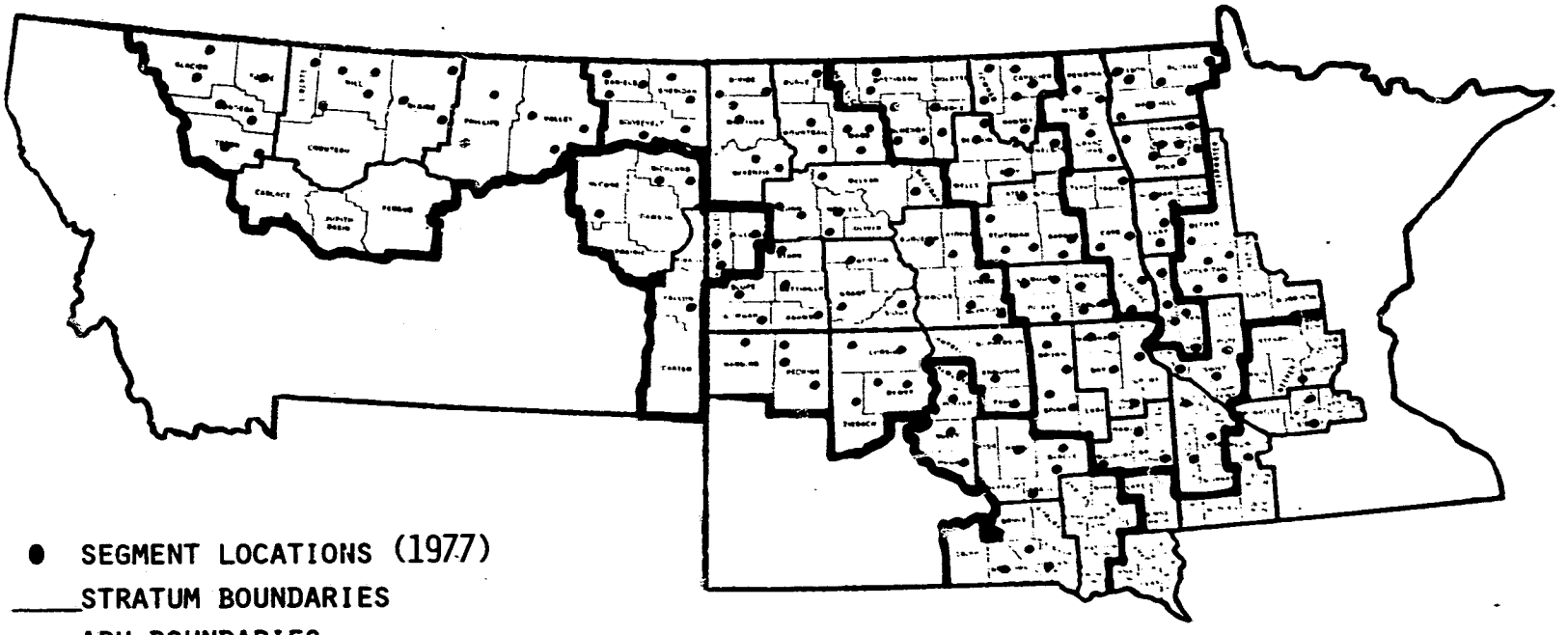


9/28/81

C-3

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	DATA SET		DATE	TEST PERIOD	
						SEGS.	ACQS.		FROM	TO
	DEVELOP-MENT	COMPARISON TEST OF SUBCOMPONENTS G-1 G-1A	AGGREGATION	SUB-COMPONENT	MN ND MT SD	1977 177			5/7	8/7/81

MAP OF TEST SEGMENT LOCATIONS



● SEGMENT LOCATIONS (1977)

STRATUM BOUNDARIES

APU BOUNDARIES

9/28/81

10

TEST NO.	TEST TYPE	CRP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	DATA SET SEGS.	DATA SET ACQS.	DATE	TEST PERIOD FROM	TEST PERIOD TO
	DEVELOP-MENT	COMPARISON TEST OF SUBCOMPONENTS G-1 G-1A	AGGREGATION	SUB-COMPONENT	MN ND MT SD	1977 177			5/7	8/7/81

DATA SET DISCUSSION

THE 1977 CAMS SSG SEGMENT DATA WAS CHOSEN BECAUSE IT PROVIDES THE DENSEST COVERAGE OF THE U.S. SPRING SMALL GRAINS REGION (AS A WHOLE) OF ANY OF THE AVAILABLE YEARS OF ARCHIVED CAMS DATA (1976 - 1979) WHILE STILL RETAINING SOME AREAS WITH ONLY MINIMAL COVERAGE (OR NONE AT ALL). THIS DENSE COVERAGE WILL FACILITATE THE SUBDIVISION OF THE 4-STATE REGION INTO MANY SMALL 'STRATA' FOR THE PURPOSES OF THIS TEST.

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TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	DATA SET		DATE	TEST PERIOD	
						SEGS.	ACQS.		FROM	TO
	DEVELOP-MENT	COMPARISON TEST OF SUBCOMPONENTS G-1 G-1A	AGGREGATION	SUB-COMPONENT	MN ND MT SD	1977 177			5/7	8/7/81

GENERAL TEST DESCRIPTION

THE PURPOSE OF THE TEST IS TO COMPARE THE AGGREGATION RESULTS PRODUCED BY THE GOAT SOFTWARE WHEN THE TWO FOLLOWING STRATUM GROUPING CONVENTIONS ARE USED TO DEFINE THE GROUPING MATRIX, L:

UNRESTRICTED GROUPING CRITERIA:

A RATIOING GROUP MAY BE EXPANDED TO INCLUDE ANY STRATUM HAVING A COMMON BOUNDARY WITH SOME STRATUM ALREADY IN THE GROUP.

RESTRICTED GROUPING CRITERIA:

A RATIOING GROUP MAY BE EXPANDED TO INCLUDE A GIVEN STRATUM ONLY IF IT HAS A COMMON BOUNDARY WITH SOME STRATUM ALREADY IN THE GROUP AND LIES IN THE SAME APU AS THE STRATA ALREADY IN THE GROUP.

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	DATA SET		DATE	TEST PERIOD	
						SEGS.	ACQS.		FROM	TO
	DEVELOP-MENT	COMPARISON TEST OF SUBCOMPONENTS G-1 G-1A	AGGREGATION	SUB-COMPONENT	MN ND MT SD	1977 177			5/7	8/7/81

PROCEDURE

DIVIDE THE 4-STATE REGION INTO 43 (ARTIFICIAL) STRATA COMPOSED OF 3-5 COUNTIES EACH. ALL THE COUNTIES IN ANY GIVEN STRATUM SHOULD LIE IN THE SAME APU.

USE THE SINGLE YEAR AGGREGATION SUBCOMPONENT (SFG-1) TO DETERMINE THE CROP ACREAGE AND VARIANCE ESTIMATES FOR EACH STRATUM CONTAINING ONE OR MORE SAMPLE SEGMENTS. (REFER TO THESE AS THE CAMS ACREAGE AND VARIANCE ESTIMATES)

DETERMINE THE USDA CROP ACREAGE ESTIMATE FOR EACH STRATUM FOR EACH OF THE YEARS 1972-1979.

PERFORM AGGREGATIONS OF THE STRATUM-LEVEL ESTIMATES TO THE STATE AND FOUR STATE LEVELS USING THE SOAT SOFTWARE WITH EACH OF THE FOLLOWING SETS OF INPUTS AND RESTRICTIONS:

- CAMS ACREAGE ESTIMATES, CAMS VARIANCE ESTIMATES, UNRESTRICTED GROUPING CRITERIA
- CAMS ACREAGE ESTIMATES, CAMS VARIANCE ESTIMATES, RESTRICTED GROUPING CRITERIA

IN EVERY CASE, THE RATIOING YEAR WAS 1976 AND THE USDA ACREAGE ESTIMATES FOR ALL YEARS (1972-1979) WERE USED FOR THE REQUIRED HISTORICAL DATA INPUTS.

DETERMINE THE 1977 USDA ESTIMATE OF CROP ACREAGE FOR THE ENTIRE 4-STATE REGION AND FOR EACH INDIVIDUAL STATE.

CALCULATE SUMMARY DESCRIPTIVE STATISTICS WHICH EMPHASIZE THE RELATIVE STRENGTHS AND WEAKNESSES OF THE TWO GROUPING APPROACHES.

9/28/81

U.S./CANADA SSG PILOT

SAMPLING AND AGGREGATION: GROUPING APPROACH COMPARISON STUDY

FINAL RESULTS

STATE	ESTIMATE AND ROOT MEAN SQUARE ERROR (RMSE)	RESTRICTED[1]	UNRESTRICTED[2]	USDA[3]
MINNESOTA	ACREAGE	5047.1	5104.6	5942.9
	RATIOING BIAS	-256.5	-195.3	
	S&C BIAS	-639.3	-643.0	
	RMSE	457.7	294.4	
MONTANA	ACREAGE	3657.2	2960.5	3234.0
	RATIOING BIAS	-118.8	-328.1	
	S&C BIAS	542.0	54.6	
	RMSE	426.3	206.7	
NORTH DAKOTA	ACREAGE	13479.7	13659.9	13180.0
	RATIOING BIAS	638.0	478.9	
	S&C BIAS	-58.3	1.0	
	RMSE	480.3	488.1	
SOUTH DAKOTA	ACREAGE	3904.7	3758.2	5222.5
	RATIOING BIAS	-180.3	-770.4	
	S&C BIAS	-1137.5	-693.9	
	RMSE	449.3	344.7	
FOUR-STATE AREA	ACREAGE	26088.6	25483.1	27579.4
	RATIOING BIAS	82.4	-814.9	
	S&C BIAS	-1573.2	-1281.4	
	RMSE	1096.4	861.7	
	COEFFICIENT OF VARIATION	3.98%	3.12%	
	RELATIVE ERROR	-5.41%	-6.30%	

14

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	DATA SET		DATE	TEST PERIOD	
						SEGS.	ACQS.		FROM	TO
	DEVELOP-MENT	COMPARISON TEST OF SUBCOMPONENTS G-1 G-1A	AGGREGATION	SUB-COMPONENT	MN ND MT SD	1977 177			5/7	8/7/81

TEST RESULTS

DEFINITIONS OF STATISTICS IN SUMMARY TABLE:

1 - OUTPUTS ASSOCIATED WITH THE AGGREGATION EMPLOYING THE RESTRICTED GROUPING STRATEGY.

2 - OUTPUTS ASSOCIATED WITH THE AGGREGATION EMPLOYING THE UNRESTRICTED GROUPING STRATEGY.

3 - THE USDA ACREAGE ESTIMATE FOR THE REGION.

ACREAGE EST. = THE REGION'S ESTIMATED CROP ACREAGE

RMSE = THE REGION'S ESTIMATED ROOT MEAN SQUARE ERROR

RATIOING BIAS ESTIMATE = AN ESTIMATE OF THE BIAS IN THE REGION'S ACREAGE EST. INDUCED BY RATIOING.

S&C BIAS EST. = AN ESTIMATE OF THE BIAS IN THE REGION'S ACREAGE EST. INDUCED BY SAMPLING AND CLASSIFICATION.

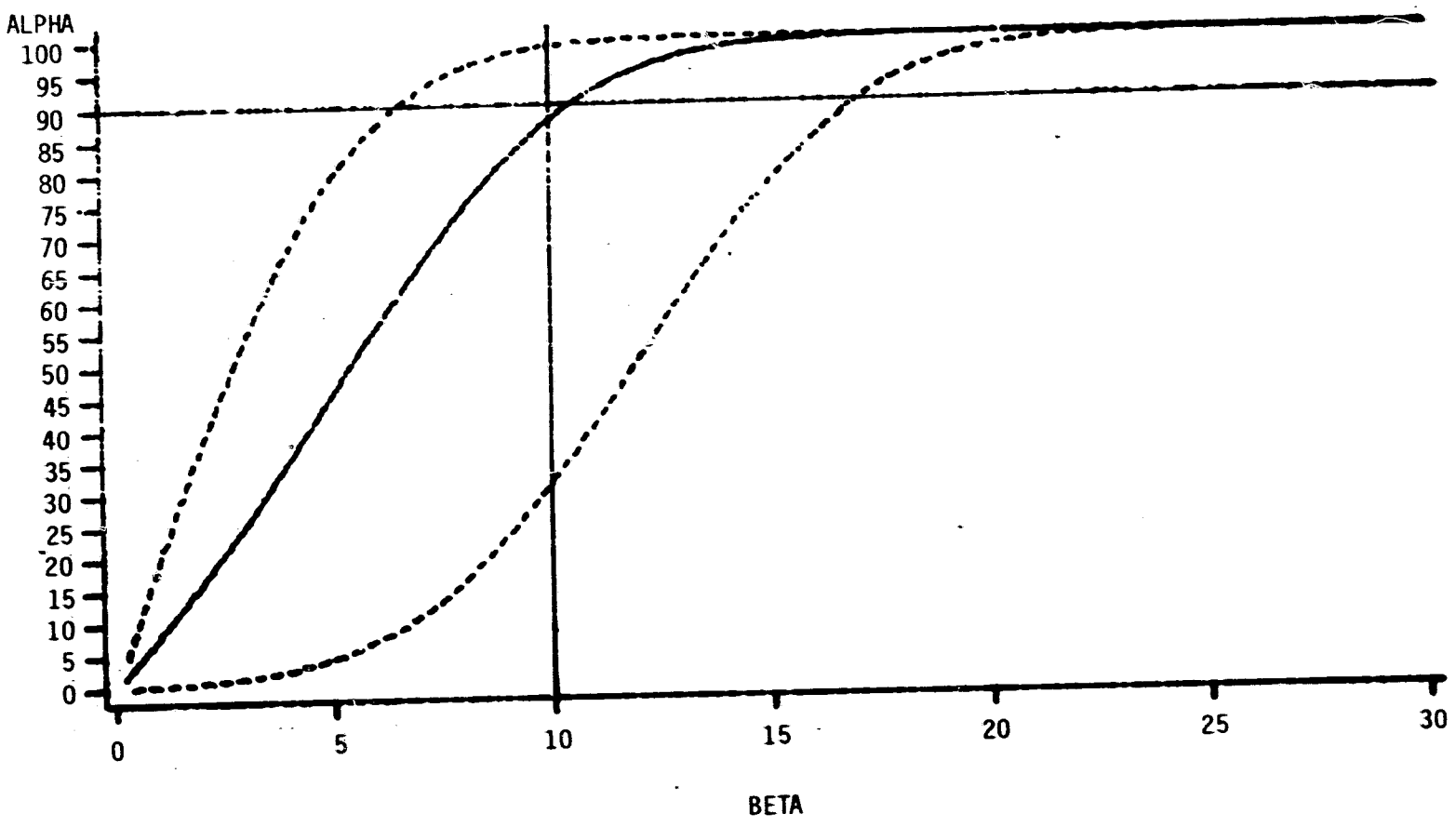
TOTAL CV = 100% × (THE REGION'S RMSE/THE REGION'S USDA ACREAGE EST.)

TOTAL RELATIVE ERROR = 100% × (THE REGION'S ACREAGE EST.-THE REGION'S USDA ACREAGE EST.)/USDA ACREAGE EST.

9/28/81

LACIE/SFG1A PERFORMANCE ENVELOPE FOR AREA

AGGREGATION OF ALL 1977 ND SEGMENT PROPS

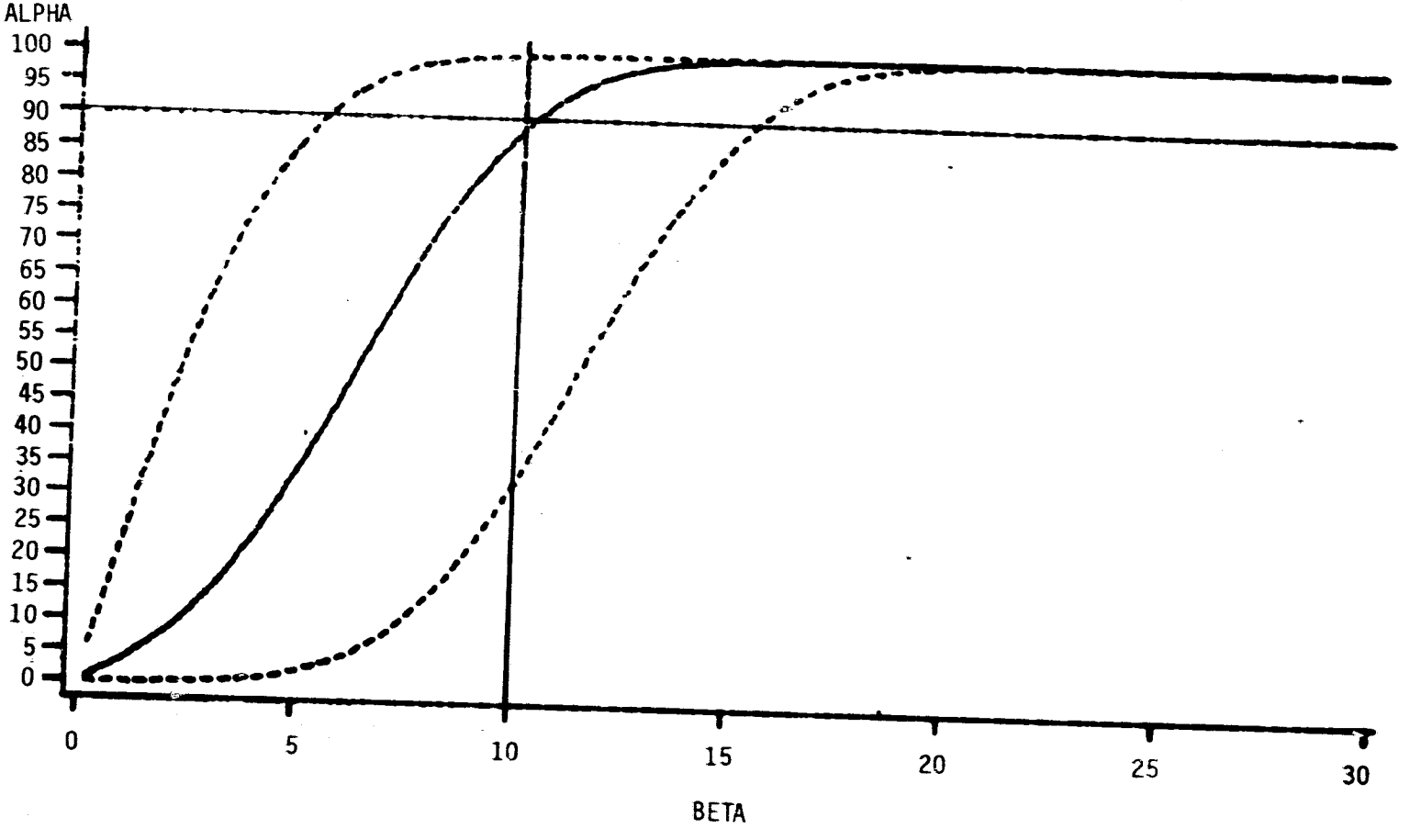


A BETA OF 1% CORRESPONDS TO AN ABSOLUTE ERROR BOUND OF 275794 ACRES

9/26/81

LACIE/SFG1 PERFORMANCE ENVELOPE FOR AREA

AGGREGATION OF ALL 1977 ND SEGMENT PROPS



A BETA OF 1% CORRESPONDS TO AN ABSOLUTE ERROR BOUND OF 275794 ACRES

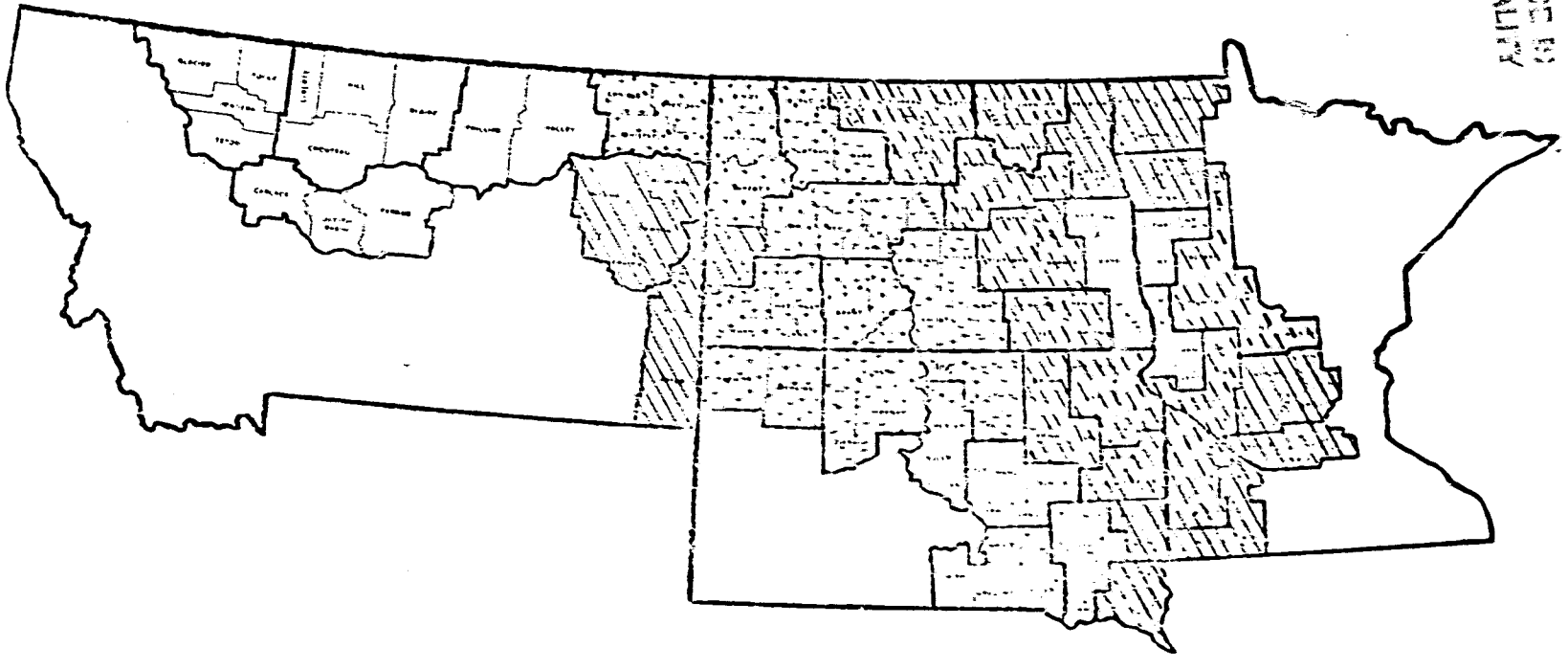
9/28/81

17

TEST NO.	TEST TYPE	CROP PROCEDURE/TIME	PROC. TYPE	TEST LEVEL	TEST REGION	DATA SET		DATE	TEST PERIOD	
						SEGS.	ACQS.		FROM	TO
	DEVELOP-MENT	COMPARISON TEST OF SUBCOMPONENTS G-1 G-1A	AGGREGATION	SUB-COMPONENT	MN ND MT SD	1977 177			5/7	8/7/81

TEST RESULTS

FINAL RESTRICTED GROUPS

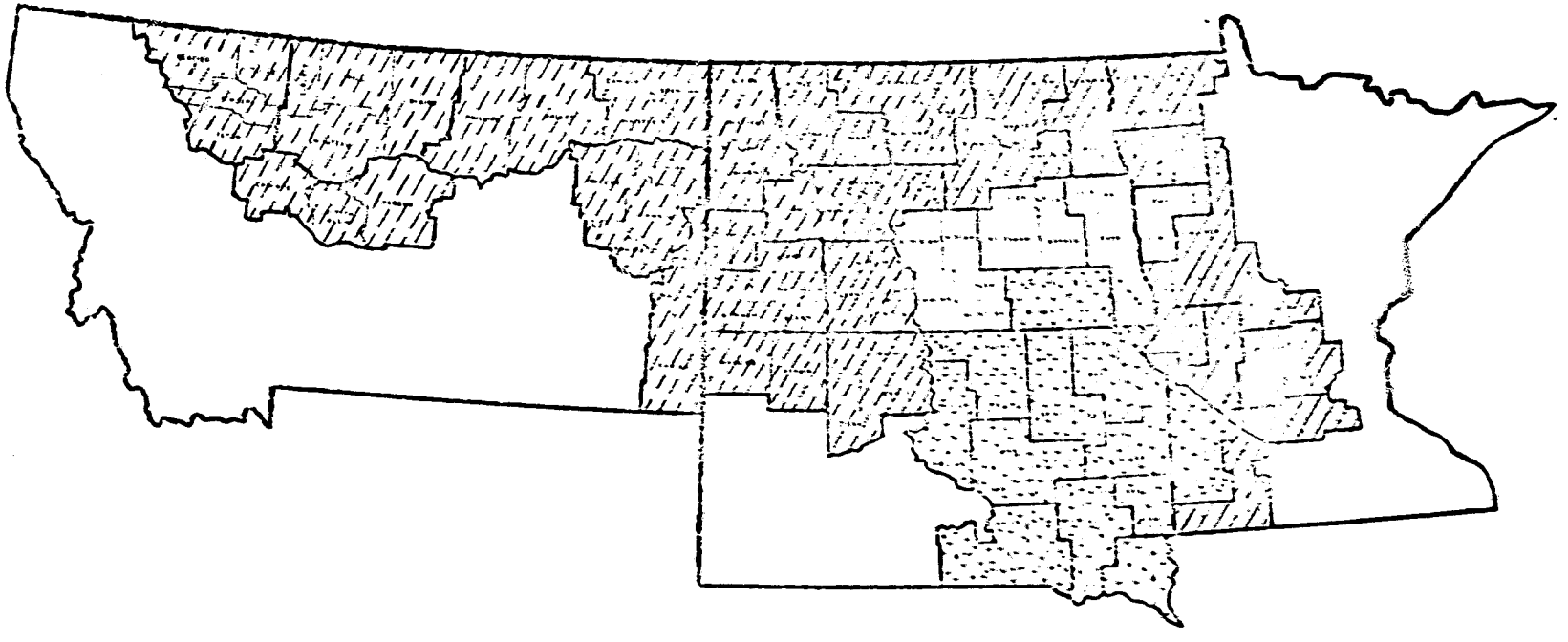


9/28/81

TEST NO.	TEST TYPE	CHIEF PROGRAMMER/TIME	PROC. TYPE	TEST LEVEL	TEST REGION	DATA SET		DATE	TEST PERIOD	
						SEGS.	ACCS.		FROM	TO
	DEVELOP-MENT	COMPARISON TEST OF SUBCOMPONENTS G-1 G-1A	AGGREGATION	SUB-COMPONENT	MN ND MT SD	1977 177			5/7	8/7/81

TEST RESULTS

FINAL UNRESTRICTED GROUPS



9/28/81

TEST NO.	TEST TYPE	CRP PROCEDURE NAME	PROC. TYPE	TEST LEVEL	TEST REGION	DATA SET		DATE	TEST PERIOD	
						SEGS.	ACQS.		FROM	TO
	DEVELOP-MENT	COMPARISON TEST OF SUBCOMPONENTS G-1 G-1A	AGGREGATION	SUB-COMPONENT	MN ND MT SD	1977 177			5/7	8/7/81

TEST RESULTS

- THE STATE-LEVEL ESTIMATES OF RATIOING BIAS DO NOT CONSISTENTLY FAVOR EITHER THE RESTRICTED OR UNRESTRICTED GROUPING STRATEGY; HOWEVER, THE FOUR STATE REGION ESTIMATES OF RATIOING BIAS CLEARLY FAVOR THE RESTRICTED GROUPING STRATEGY.

- IN THE FOUR-STATE REGION AND IN EVERY STATE EXCEPT ND, THERE IS A SUBSTANTIAL DIFFERENCE IN THE ESTIMATES OF RMSE FOR THE TWO GROUPING STRATEGIES, WITH THE UNRESTRICTED STRATEGY BEING PREFERRED. IT IS PROBABLY SIGNIFICANT THAT ND IS DENSELY COVERED BY SEGMENT DATA WHILE THE OTHER THREE STATES ARE NOT.

- AT THE FOUR-STATE LEVEL, THE GAIN AFFORDED BY EMPLOYING THE RESTRICTED GROUPING STRATEGY IS A 1% (ABSOLUTE) REDUCTION OF THE RELATIVE ERROR (14% RELATIVE DECREASE); THE COST OF THIS GAIN IS A 1% (ABSOLUTE) INCREASE IN CV (25% RELATIVE INCREASE).

TEST I.D.	TEST TYPE	CORP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	DATA SET		DATE	TEST PERIOD	
						SEGS.	ACCS.		FROM	TO
	DEVELOP-MENT	COMPARISON TEST OF SUBCOMPONENTS G-1 G-1A	AGGREGATION	SUB-COMPONENT	MN ND MT SD	1977 177			5/7	8/7/81

EVALUATIONS/RECOMMENDATIONS

- IN FUTURE AGGREGATIONS EMPLOYING THE GOAT, USE A RESTRICTED GROUPING STRATEGY IF -

  1) THE REGION TO BE AGGREGATED HAS SOME AREA(S) COVERED ONLY SPARSELY BY SEGMENT DATA.

  2) A VIABLE BASIS FOR RESTRICTION IS AVAILABLE (E.G., FROM GEOGRAPHIC, POLITICAL, METEOROLOGICAL, ETC. CONSIDERATIONS), AND

  3) THE ANTICIPATED INCREASE IN ESTIMATED RMSE IS ACCEPTABLE.

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	SEGS.	YEAR(S)	DATE	TEST PERIOD	
									FROM	TO
	DEVELOP-MENT	COMPARISON TEST OF SUBCOMPONENTS G-1 AND G-1A	AGGREGATION	SUB-COMPONENT	MN, MT, ND, SD	1977 1978			5/7 /81	8/7 /81

EXTENSIBILITY AND APPLICABILITY QUESTIONS

- INVESTIGATIONS OF HISTORICAL DATA INDICATE THAT USING GROUPS OF THREE TO FIVE COUNTIES AS STRATA DOES NOT ALTER THE NATURE OF THE HISTORICAL BEHAVIOR OF THE STRATA FROM WHAT IT WOULD BE IF STRATA THE SIZE OF LACIE "REFINED STRATA" WERE USED.

- ALL USNGP REFINED STRATA TEND TO BEHAVE SIMILARLY OVER THE YEARS, WHILE U.S.S.R. OBLASTS EXHIBIT SLIGHTLY MORE VARIABILITY. THE NONUNIFORM BEHAVIOR WILL TEND TO PROMOTE THE FORMATION OF SMALLER RATIOING GROUPS - HENCE REDUCING THE NECESSITY FOR ARTIFICALLY RESTRICTED GROUP MEMBERSHIP.

PRELIMINARY AGGREGATION RESULTS FOR THREE SSG PROCESSING PROCEDURES

T. C. BAKER
9/28/81

TEST NO.	TEST TYPE	CROP PROCEDURE/NAME	PROC. TYPE	TEST LEVEL	TEST REGION	SEGS.	YEAR(S)	DATE	TEST PERIOD	
									FROM	TO
14	PILOT	COMPARISON OF 3 AGGREGATION SYSTEMS	AGGREGATION	COMPONENT	MN ND MT SD		76-79	9/28/81	4-1	9-15
ONE-STATE AGGREGATIONS/PRELIMINARY RESULTS										

OBJECTIVE: DEMONSTRATE STATE-OF-THE-ART AREAL ESTIMATION FOR SSG USING SSG2, SSG3B, SSG3C, AND SSG4.

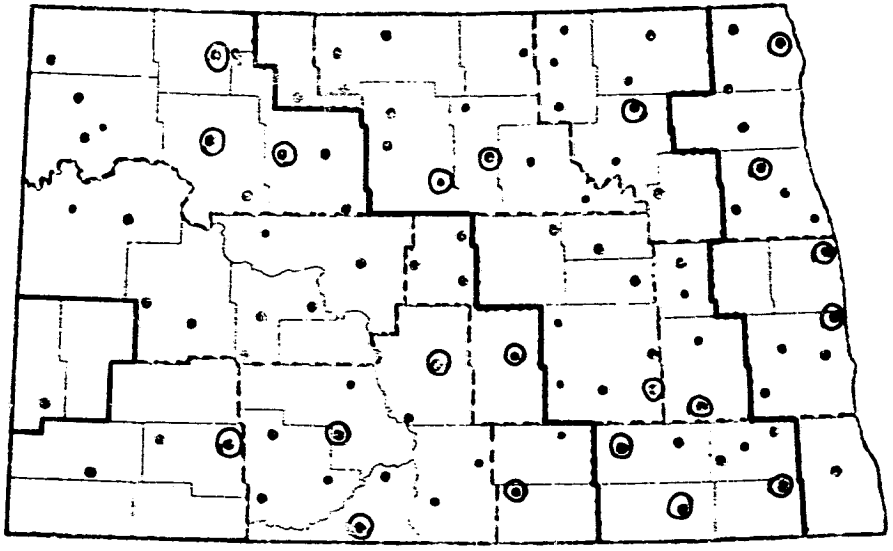
SCOPE: ESTIMATE THE SSG AREA FOR ND/1978 VIA AGGREGATION OF THE PROPORTION ESTIMATES RESULTING FROM EACH PROCEDURE.

EVALUATIONS: COMPARE THE AGGREGATED ACREAGE ESTIMATES TO THE USDA STANDARD.

ESTIMATE THE COMPONENTS OF "OBSERVED ERROR" (BIAS) IN THE AGGREGATED ACREAGE ESTIMATES.

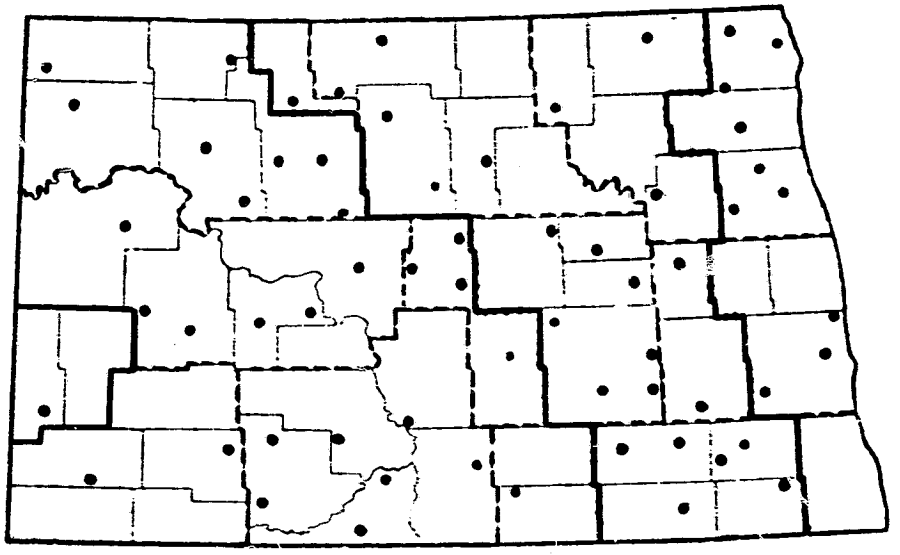
ESTIMATE THE COMPONENTS OF VARIANCE FOR THE AGGREGATED ACREAGE ESTIMATES.

SEGMENTS SUBMITTED FOR PROCESSING



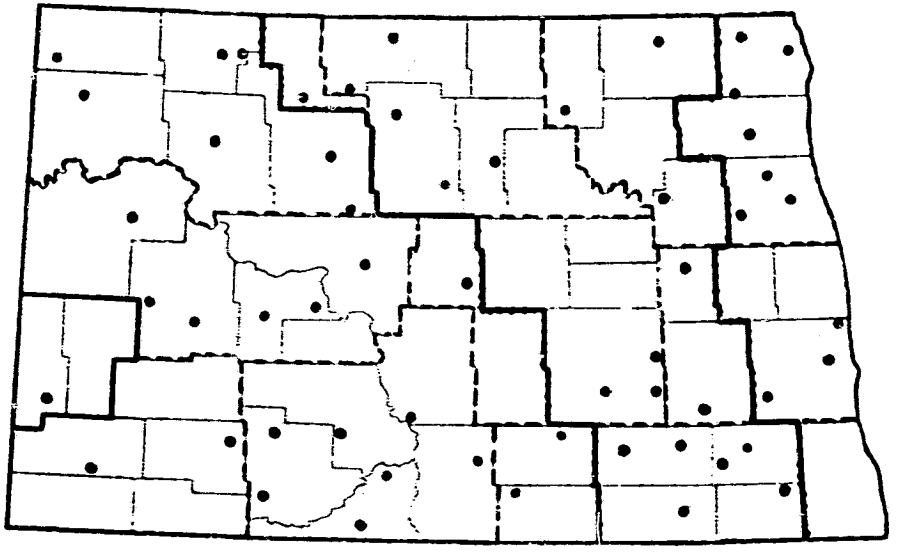
9/28/81

SEGMENTS WITH SSG3B PROPORTION ESTIMATES



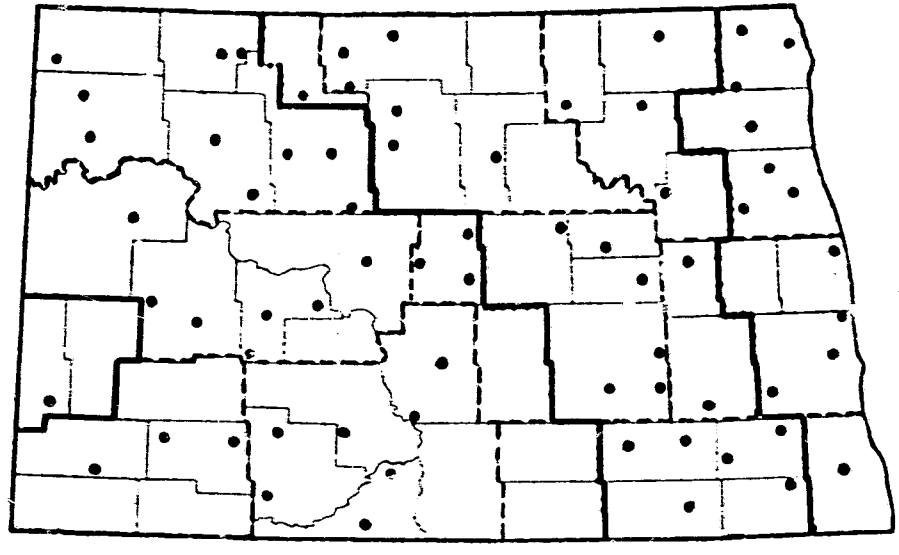
9/28/81

SEGMENTS WITH SSG3C PROPORTION ESTIMATES



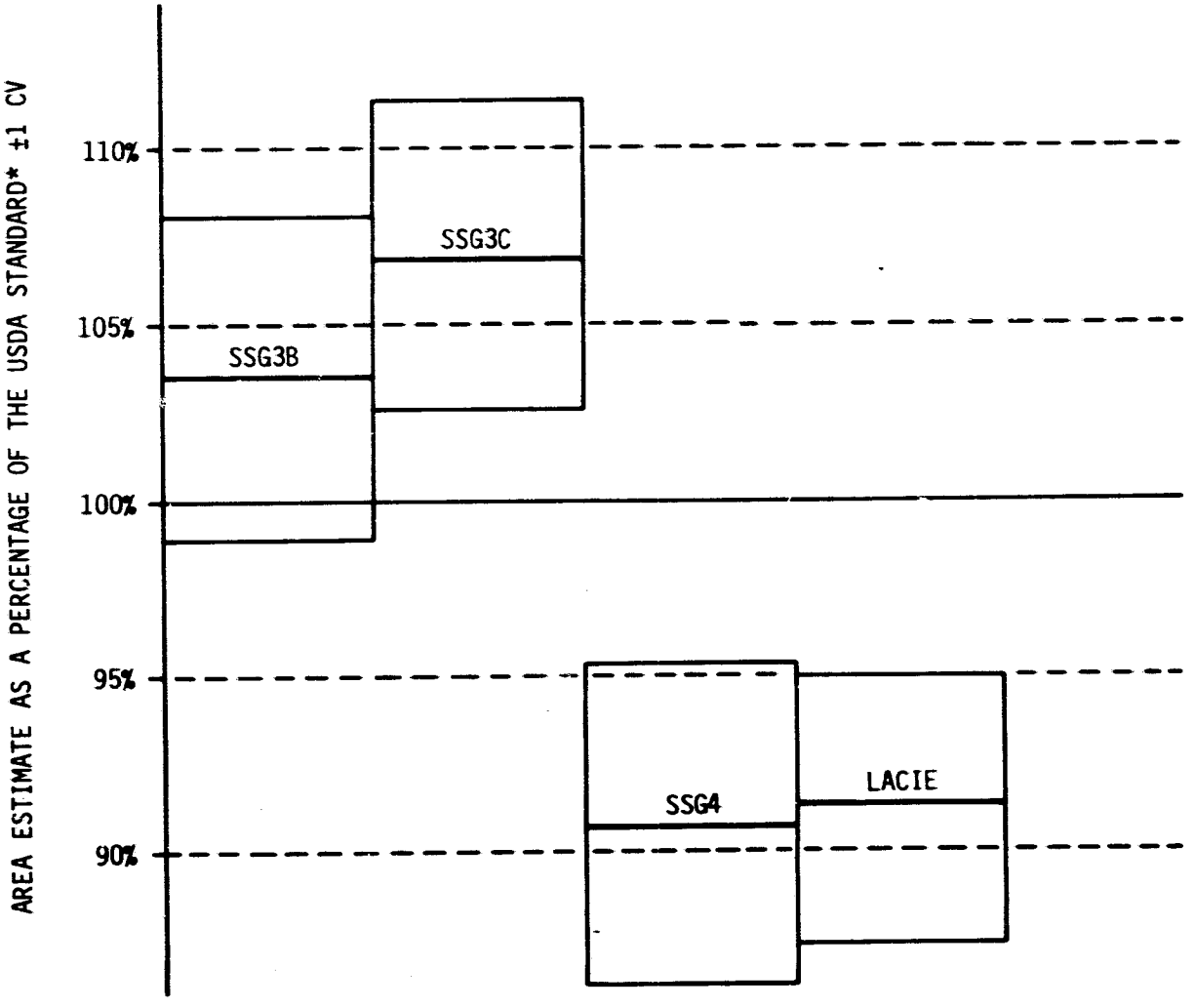
9/28/81

SEGMENTS WITH SSG4 PROPORTION ESTIMATES



9/28/81

ONE-STATE AGGREGATIONS/PRELIMINARY AREA ESTIMATION RESULTS



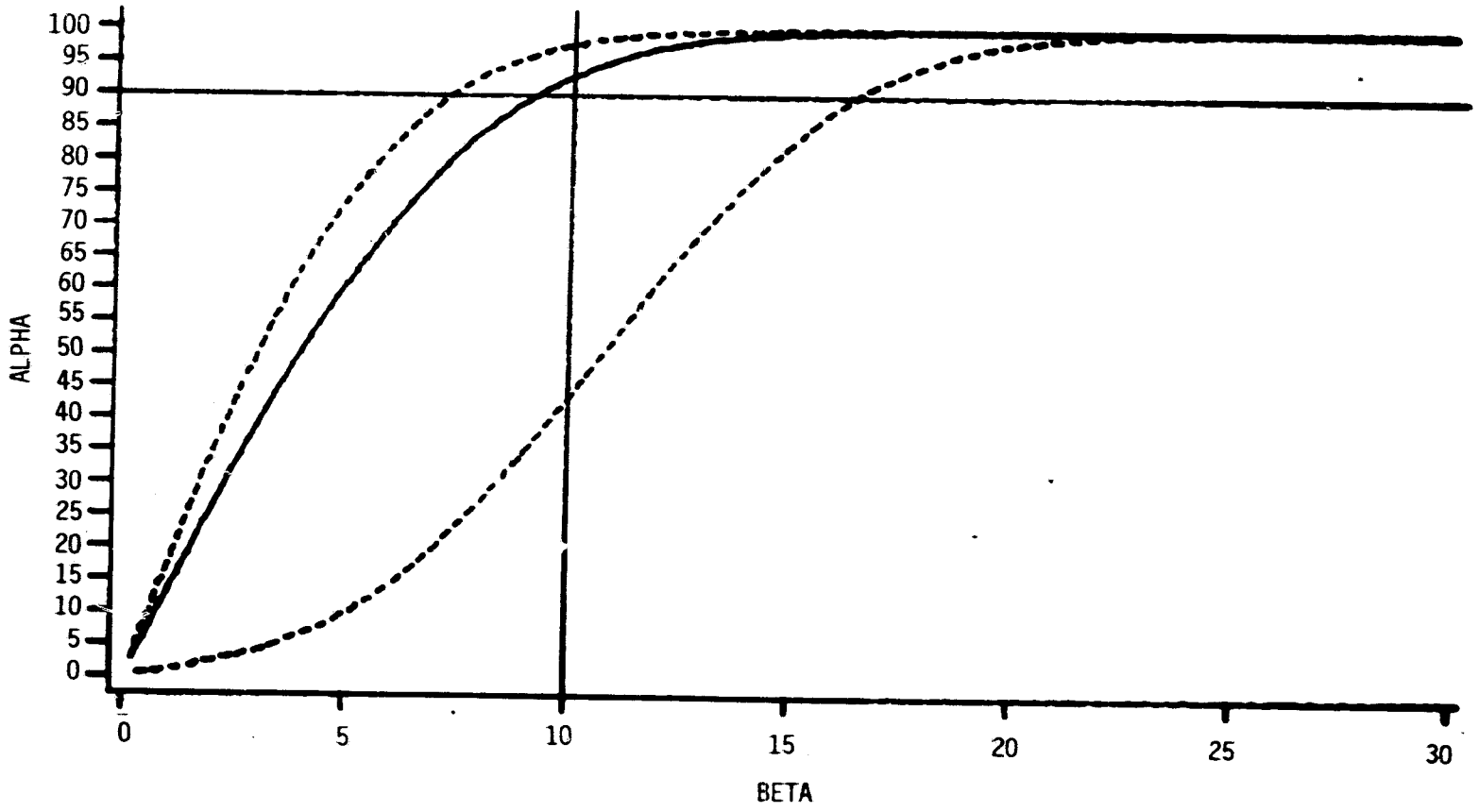
*ND 1978 SSG ACREAGE; 13,120,000

9/28/81

8

SSG3B/SFG1 PERFORMANCE ENVELOPE FOR AREA

(AGGREGATION OF ALL 1978 NORTH DAKOTA SEGMENT P[illegible]JRTIONS)

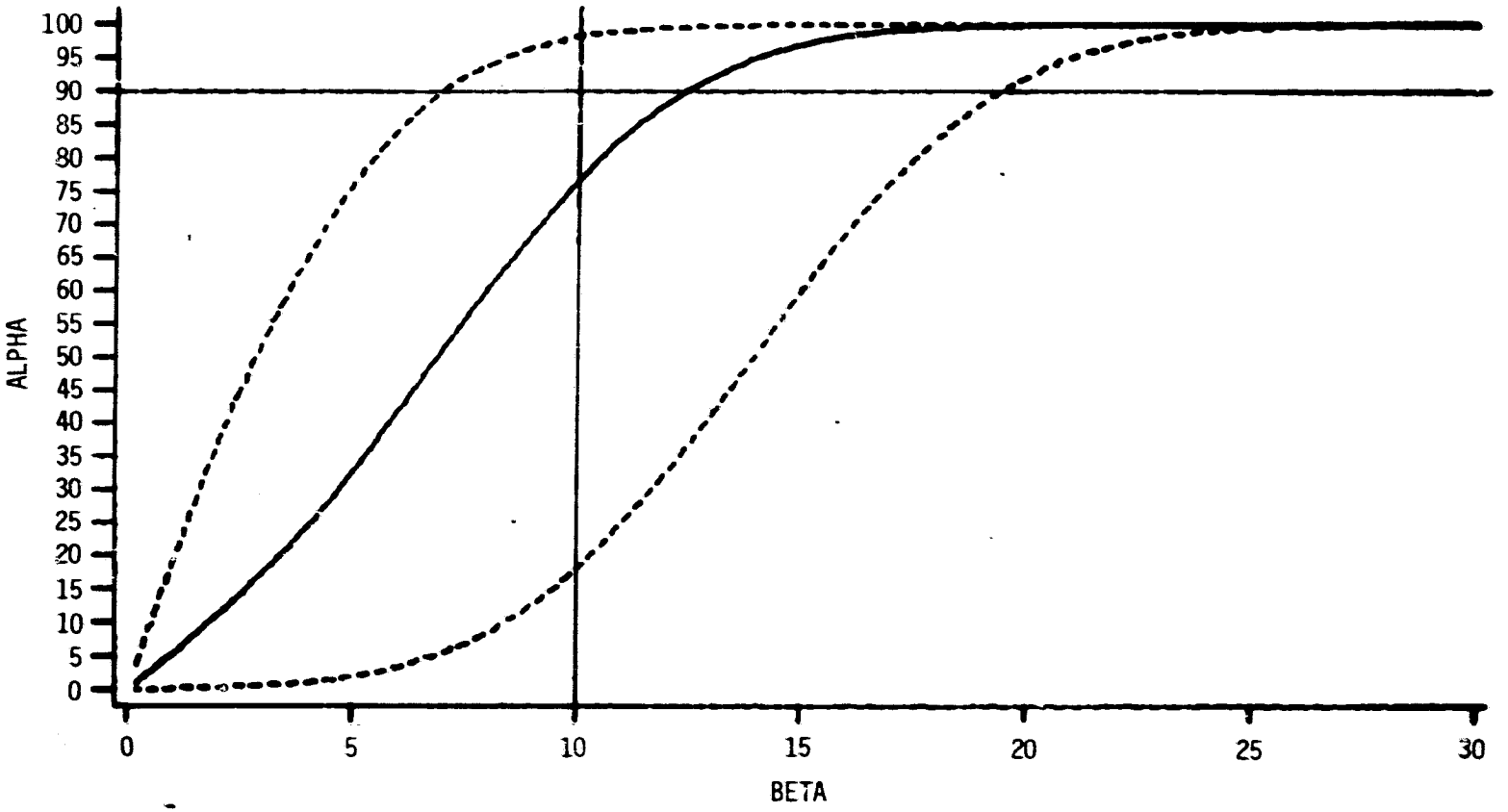


A BETA OF 1% CORRESPONDS TO AN ABSOLUTE ERROR BOUND OF 131,200 ACRES

9/28/81

SSG3C/SFG1 PERFORMANCE ENVELOPE FOR AREA

(AGGREGATION OF ALL 1978 NORTH DAKOTA SEGMENT PROPORTIONS)



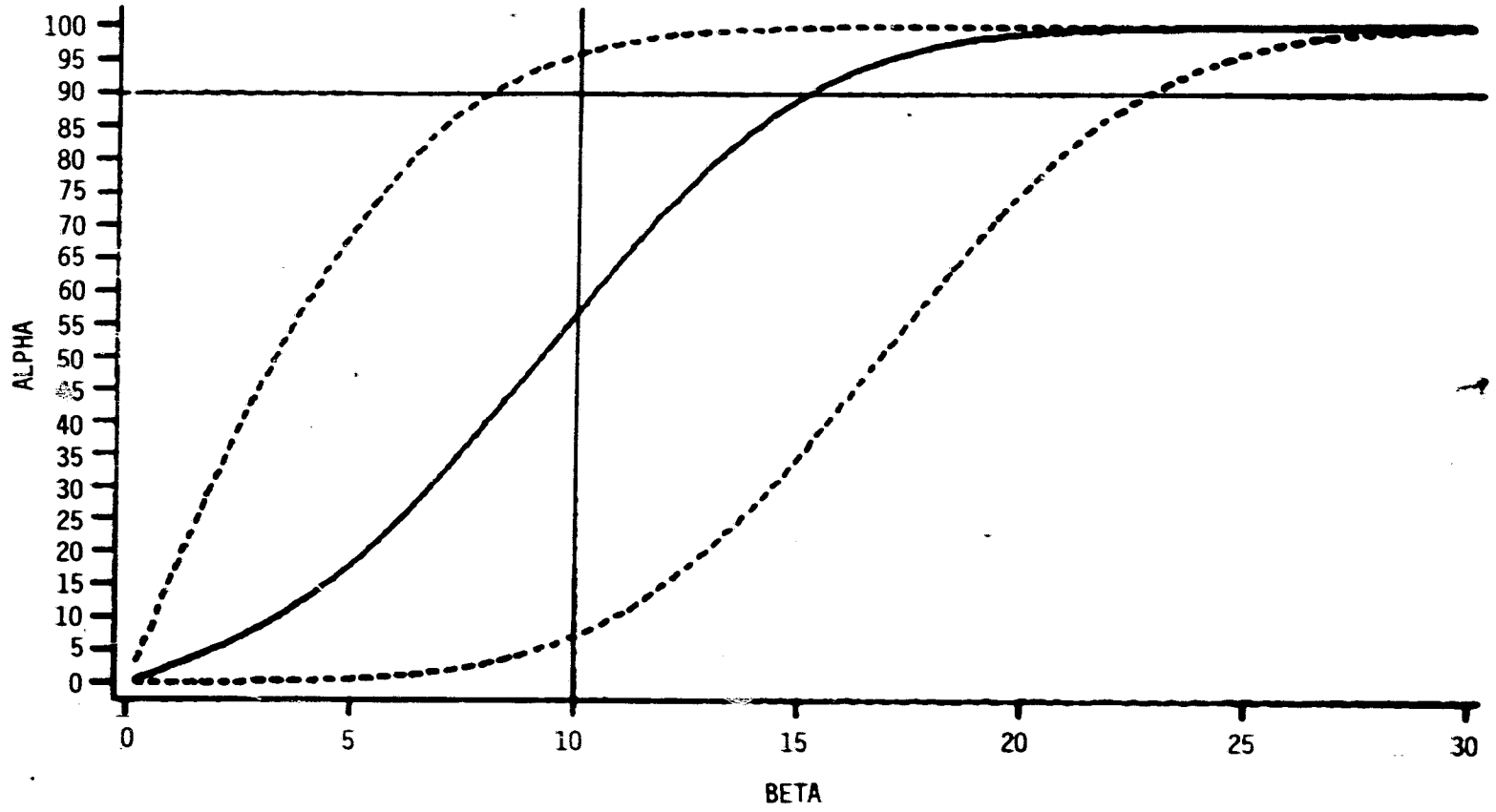
A BETA OF 1% CORRESPONDS TO AN ABSOLUTE ERROR BOUND OF 131,200 ACRES.

9/28/81

10

SSG4/SFG1 PERFORMANCE ENVELOPE FOR AREA

(AGGREGATION OF ALL 1978 NORTH DAKOTA SEGMENT PROPORTIONS)

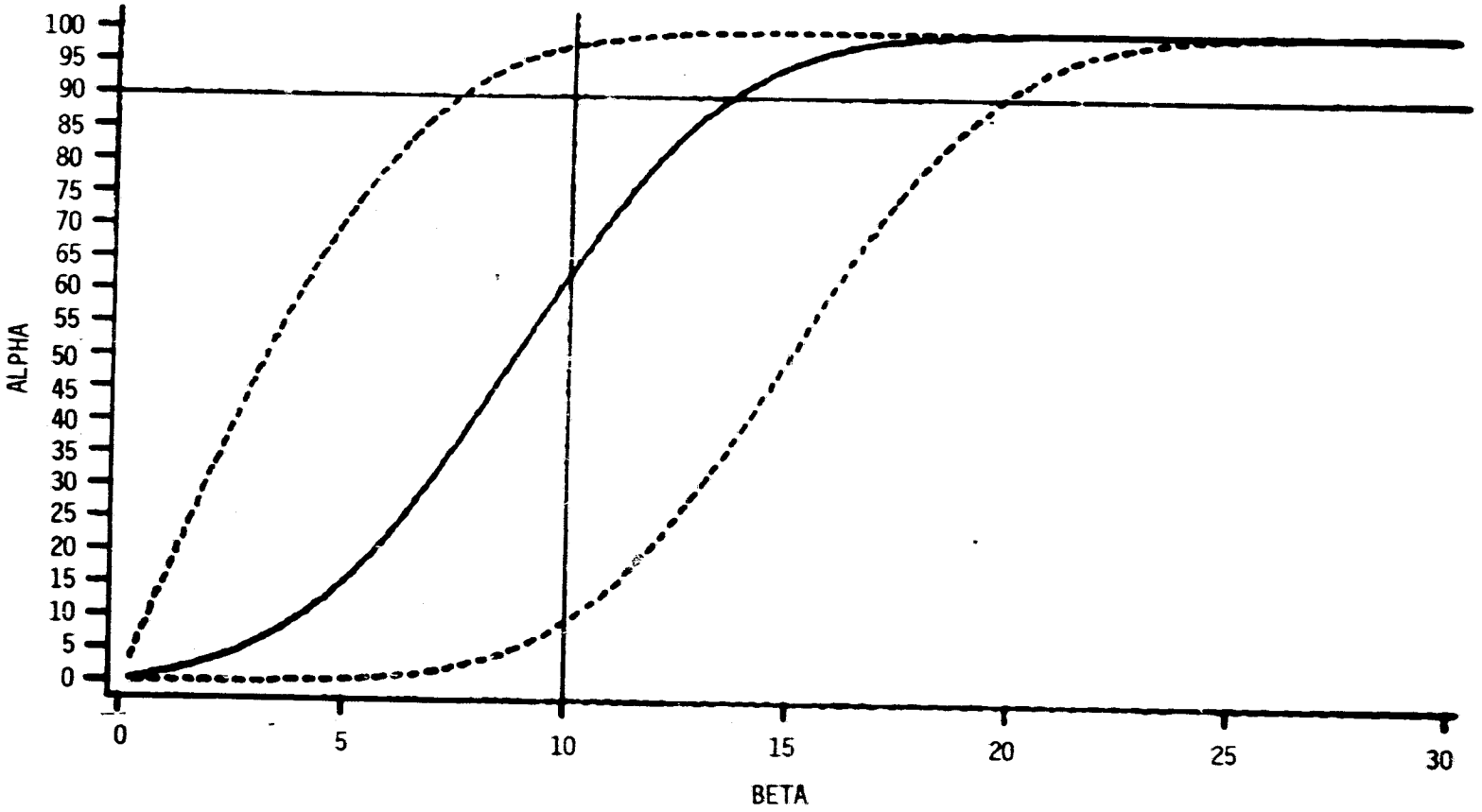


A BETA OF 1% CORRESPONDS TO AN ABSOLUTE ERROR BOUND OF 131,200 ACRES.

9/28/81

LACIE/SFG1 PERFORMANCE ENVELOPE FOR AREA

(AGGREGATION OF ALL 1978 NORTH DAKOTA SEGMENT PROPORTIONS)



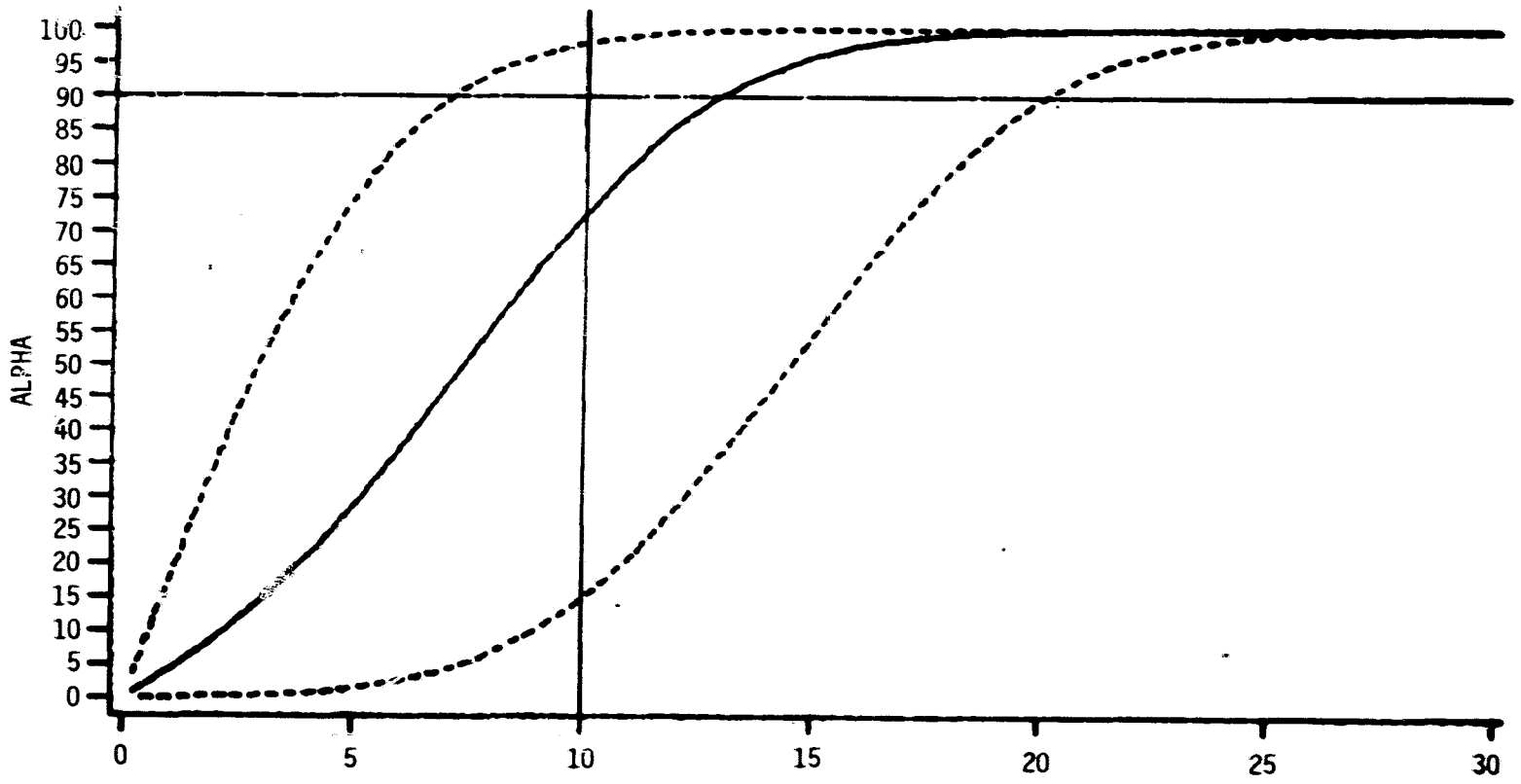
A BETA OF 1% CORRESPONDS TO AN ABSOLUTE ERROR BOUND OF 131,200 ACRES.

9/28/81

12

LACIE/SFS1 PERFORMANCE ENVELOPE FOR AREA

(AGGREGATION OF ALL 1978 NORTH DAKOTA SEGMENT PROPORTIONS)



A BETA OF 1% CORRESPONDS TO AN ABSOLUTE ERROR BOUND OF 131,200 ACRES.

9/28/81

ONE-STATE AGGREGATIONS PRELIMINARY
AREA ESTIMATION RESULTS

PROCEDURE	ESTIMATE (1000'S)	"OBSERVED" ERROR (1000'S)	STANDARD DEVIATION (1000'S)	RELATIVE ERROR	COEFFICIENT OF VARIATION	NUMBER OF SEGMENTS
SSG3B/SFG-1	13,572.84	452.84	582.92	3.45%	4.44%	62
SSG3C/SFG-1	14,026.48	906.48	558.79	6.91%	4.26%	56
SSG4/SFG-1	11,912.00	-1208.00	605.45	-9.21%	4.61%	68
LACIE/SFG-1	11,962.46	-1157.54	488.07	-8.82%	3.72%	76

USDA STANDARD = 13,120.0

SSG3B = SEMIAUTOMATIC CAESAR

SSG3C = AUTOMATIC CAESAR

SSG4 = SPATIAL COLOR SEQUENCE

LACIE = DETAILED ANALYSIS PROCEDURE USED IN TY

SFG-1 = SSG BASELINE AGGREGATION TECHNOLOGY

9/28/81

ONE-STATE AGGREGATIONS PRELIMINARY AREA AREA ESTIMATION RESULTS EXPRESSED AS A PERCENTAGE OF THE USDA STANDARD

PROCEDURE	ESTIMATE	CV	COMPONENTS OF RELATIVE ERROR							
			TOTAL		RATIOING		SAMPLING		CLASSIFICATION	
			ESTIMATE	STANDARD ERROR	ESTIMATE	STANDARD ERROR	ESTIMATE	STANDARD ERROR	ESTIMATE	STANDARD ERROR
SSG3B	103.45	4.44	3.83	9.40	-2.67	-	4.38	5.17	2.12	7.86
SSG3C	106.91	4.26	8.44	8.22	-2.35	-	3.52	5.46	7.27	6.58
SSG4	90.79	4.61	-0.74	8.16	-1.08	-	12.84	4.97	-12.50	6.75
LACIE	91.18	3.72	-9.73	5.56	-3.74	-	7.22	4.64	-13.20	3.72

9/28/81

STUDIES PROMPTED BY HIGH VARIABILITY IN ESTIMATE OF RELATIVE ERROR IN ONE-STATE AGGREGATIONS

- ONE-STATE AGGREGATIONS OF THOSE GROUND-TRUTH SEGMENTS PROCESSED BY ALL PROCEDURES (1978 ND ONLY).
- FOUR-STATE AGGREGATIONS OF GROUND-TRUTH SEGMENT PROCESSINGS FOR ALL THREE PROCEDURES IN EACH OF 1976-79.

9/28/81

ONE-STATE AGGREGATIONS

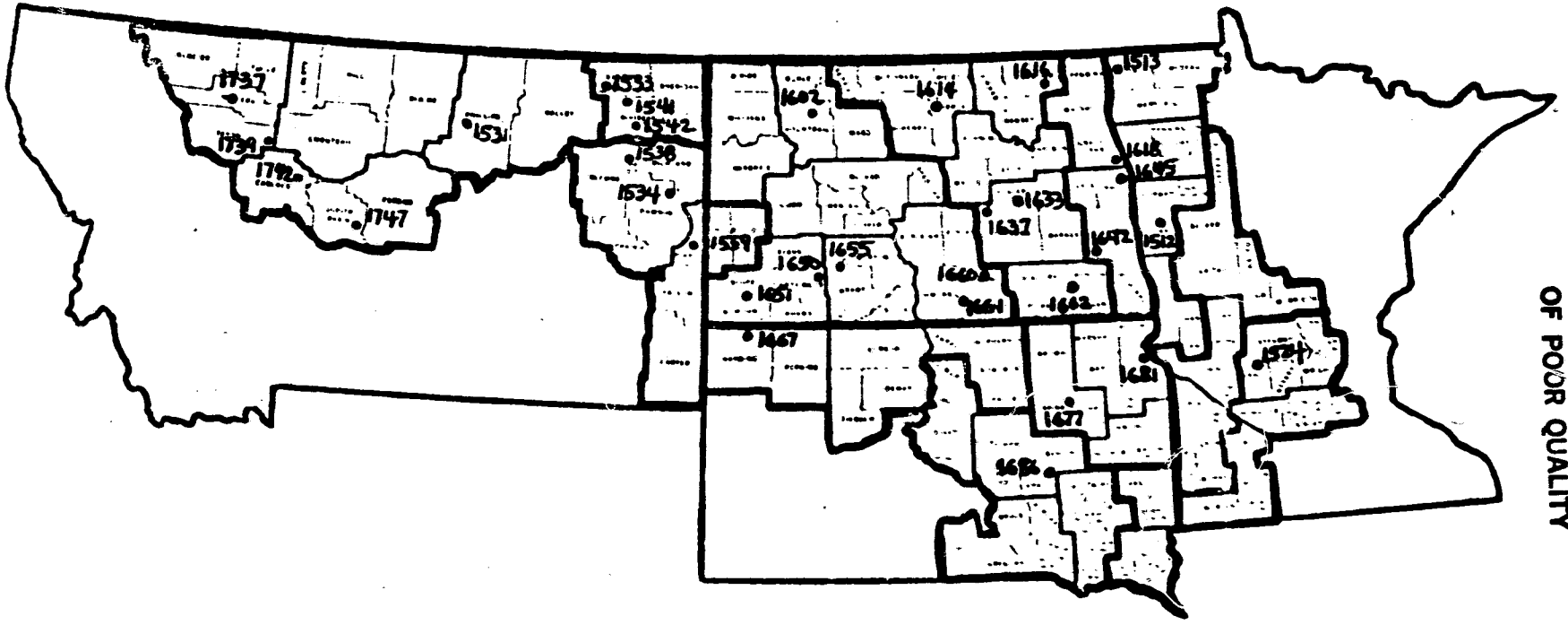
AREA ESTIMATES FOR AGGREGATIONS OF 13 GROUND-TRUTH SEGMENTS WITH PROPORTION ESTIMATES FOR ALL 4 PROCEDURES

(EXPRESSED AS A PERCENTAGE OF THE USDA STANDARD)

PROCEDURE	ESTIMATE	CV	COMPONENTS OF RELATIVE ERROR							
			TOTAL		RATIOING		SAMPLING		CLASSIFICATION	
			ESTIMATE	STANDARD ERROR	ESTIMATE	STANDARD ERROR	ESTIMATE	STANDARD ERROR	ESTIMATE	STANDARD ERROR
SSG3B	105.67	8.79	5.67		-3.46		7.05		2.08	
SSG3C	107.75	7.51	7.75		-3.43		7.02		4.16	
SSG4	92.07	6.07	-7.93		-3.38		6.96		-11.52	
LACIE	91.51	6.04	-8.49		-3.38		6.96		-12.07	
GT	103.57	4.93	3.57		-3.29		6.85		0.00	

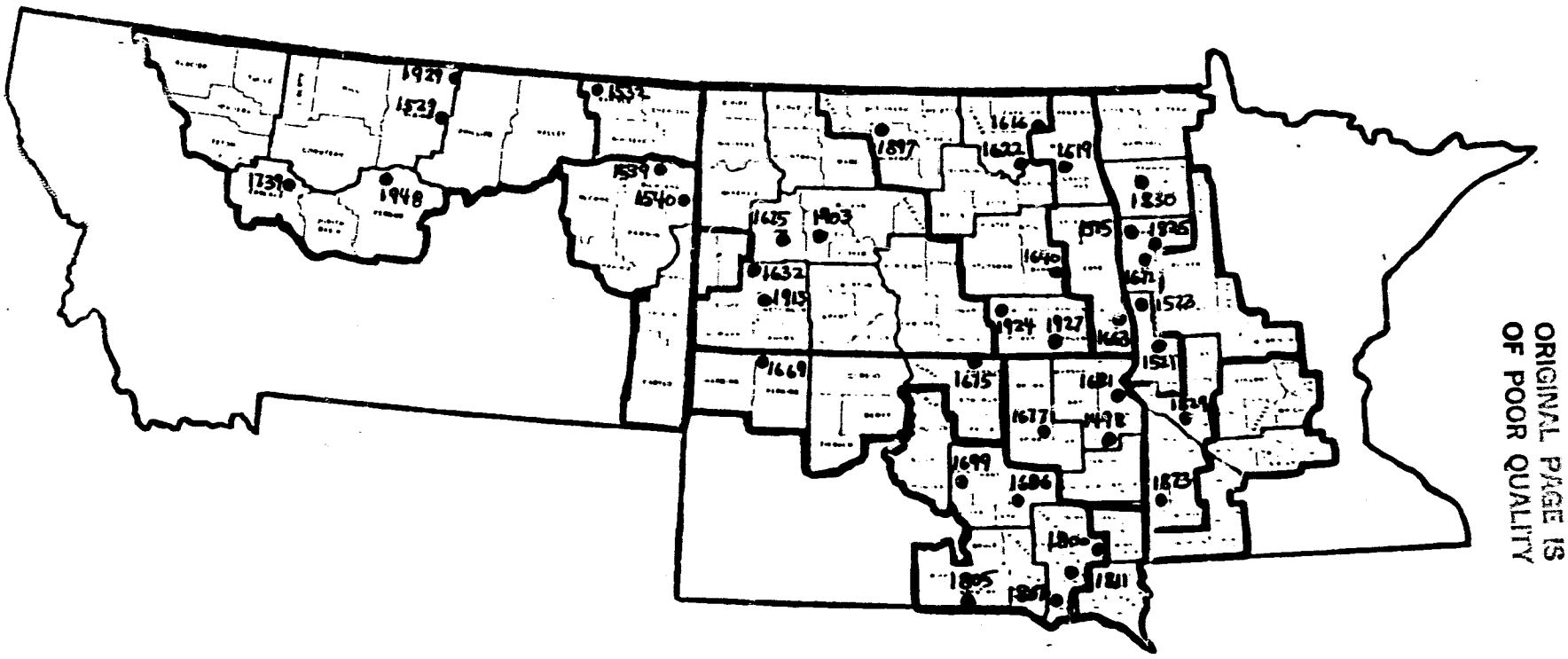
9/28/81

1976 SITES WITH GROUND TRUTH



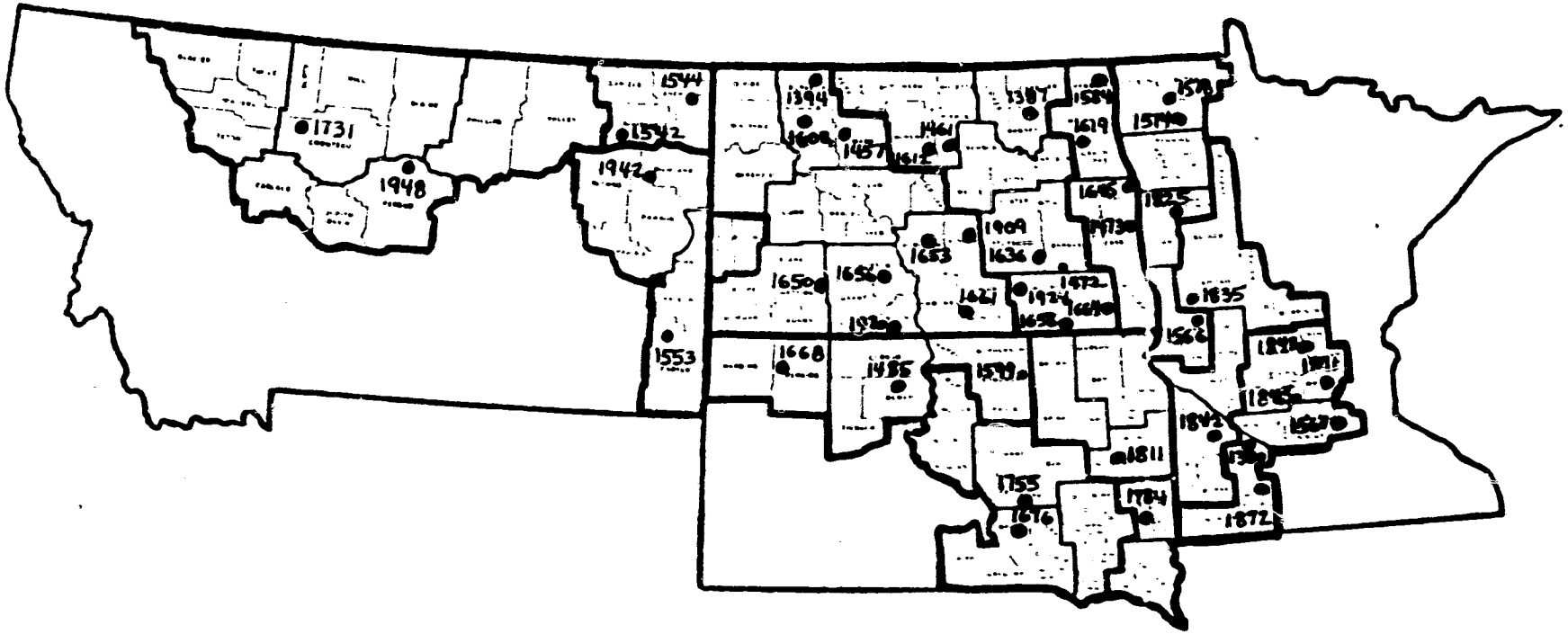
9/28/81

1977 SITES WITH GROUND TRUTH



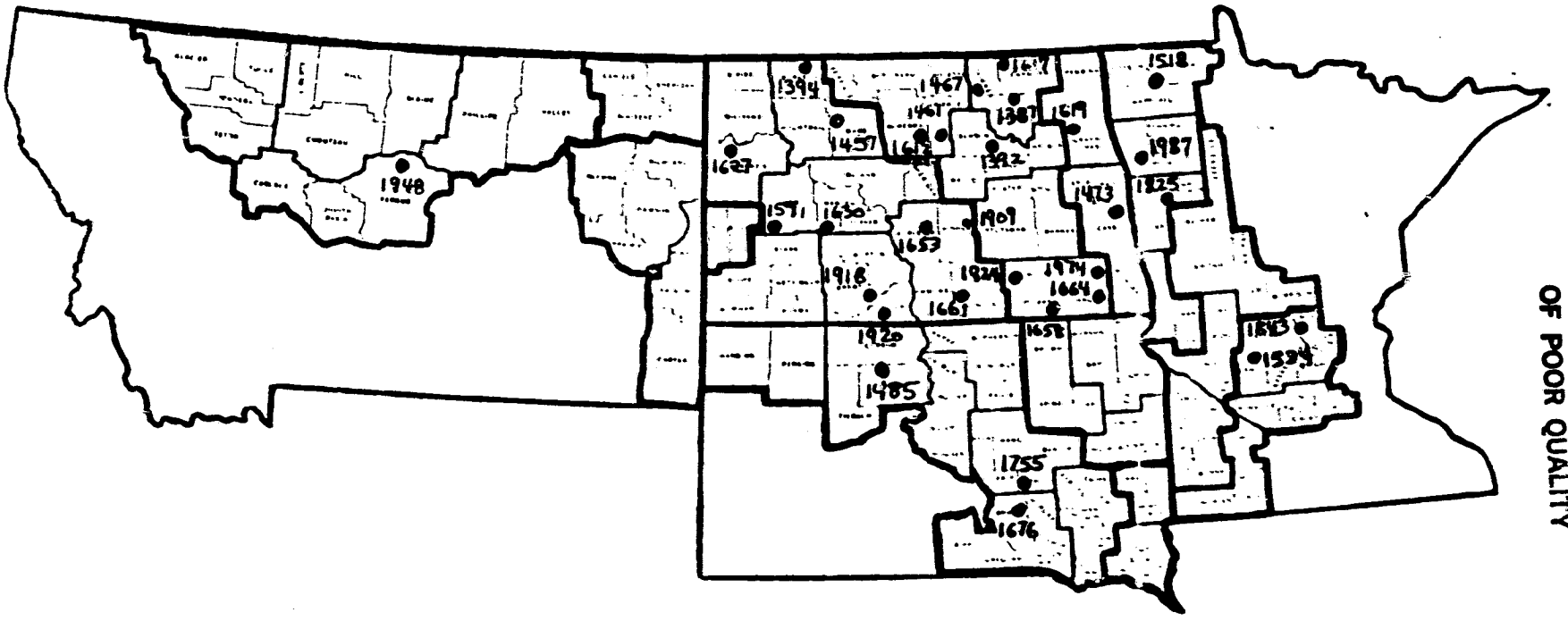
9/28/81

1978 SITES WITH GROUND TRUTH



9/28/81

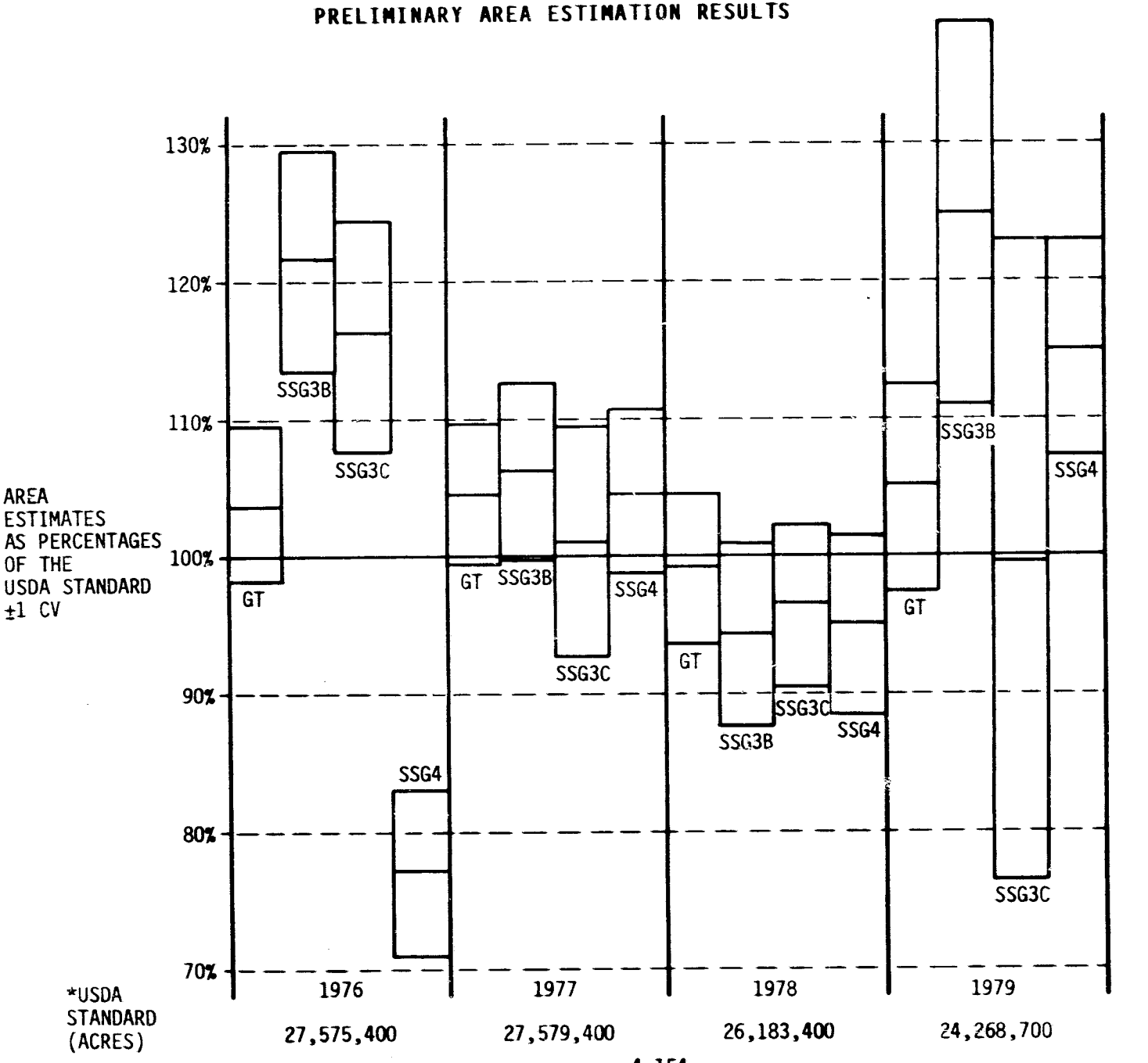
1979 SITES WITH GROUND TRUTH



9/28/81

SSG PILOT FOUR-STATE AGGREGATIONS PRELIMINARY

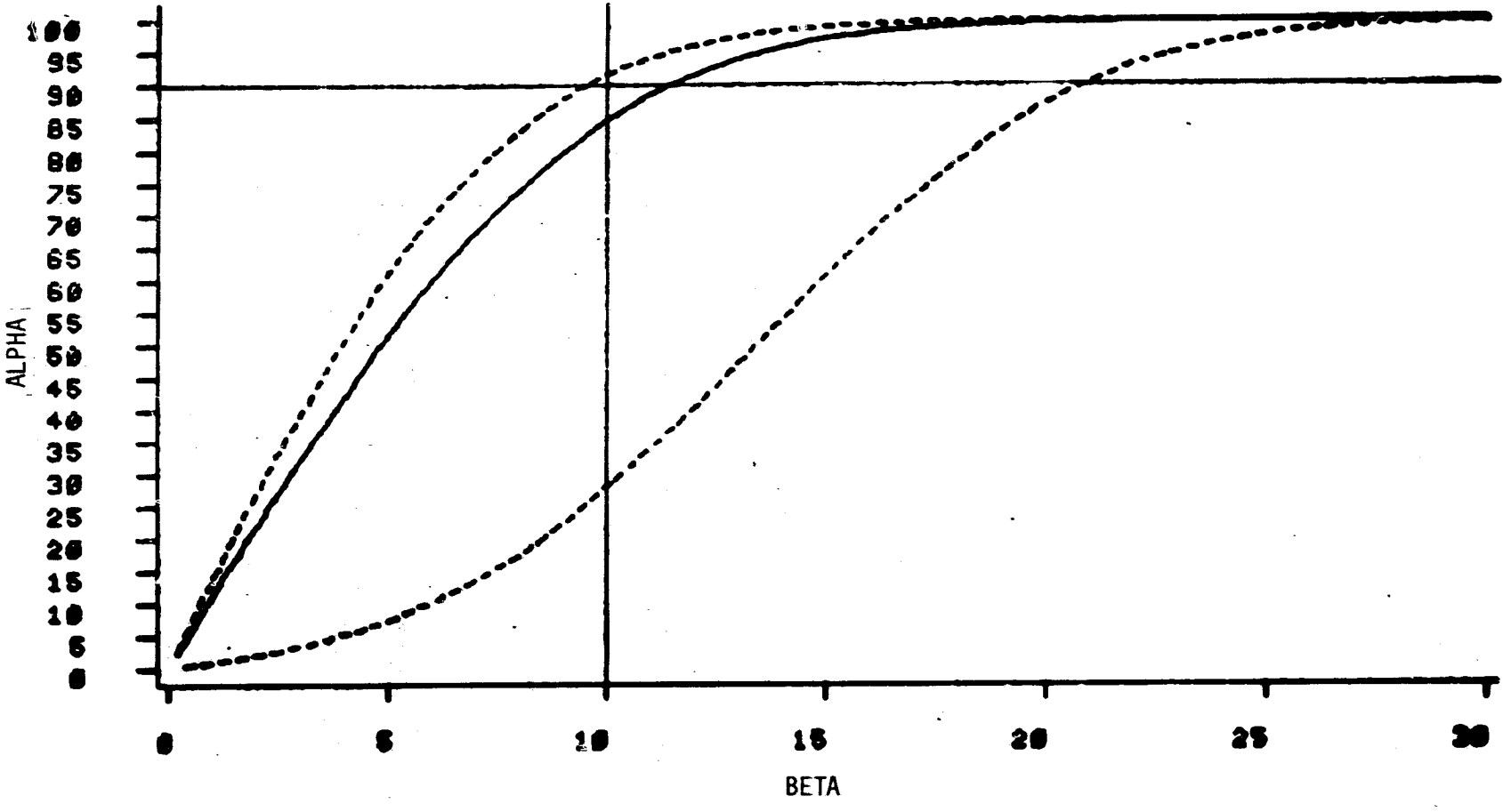
PRELIMINARY AREA ESTIMATION RESULTS



9/28/8

GT/SFG1 PERFORMANCE ENVELOPE FOR AREA

(AGGREGATION OF 1978 GROUND-TRUTH PROPORTIONS FOR MINNESOTA, MONTANA, NORTH DAKOTA, AND SOUTH DAKOTA)

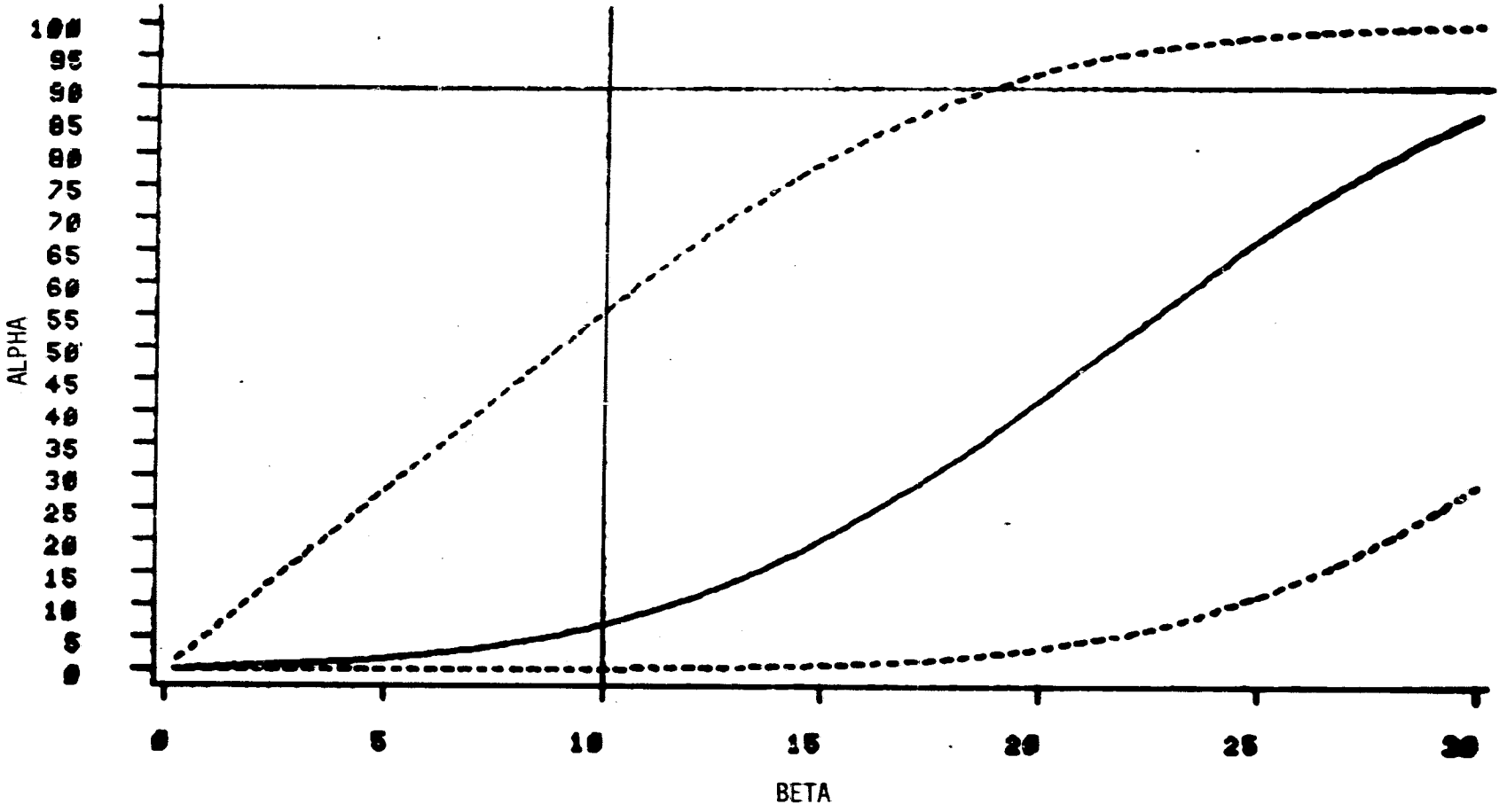


A BETA OF 1% CORRESPONDS TO AN ABSOLUTE ERROR BOUND OF 275,754 ACRES.

9/28/81

SSG3B/SFG1 PERFORMANCE ENVELOPE FOR AREA

(AGGREGATION OF PROPORTION ESTIMATES FOR 1976 GROUND-TRUTH SEGMENTS IN MINNESOTA, MONTANA, NORTH DAKOTA, AND SOUTH DAKOTA)

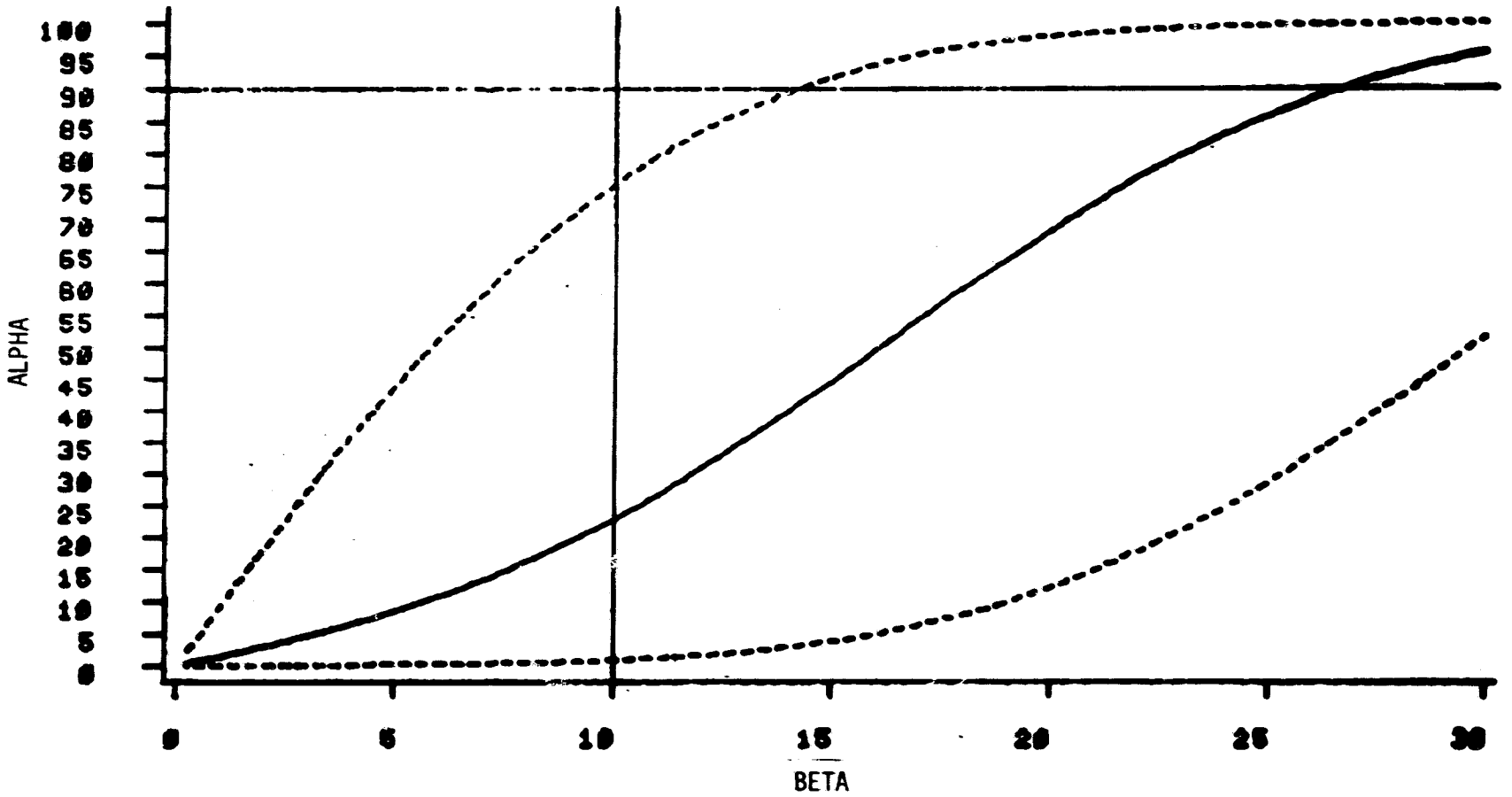


A BETA OF 1% CORRESPONDS TO AN ABSOLUTE ERROR BOUND OF 275,754 ACRES.

9/28/81

SSG3C/SFG1 PERFORMANCE ENVELOPE FOR AREA

(AGGREGATION OF PROPORTION ESTIMATES FOR 1976 GROUND-TRUTH SEGMENTS IN MINNESOTA
MONTANA, NORTH DAKOTA, AND SOUTH DAKOTA)

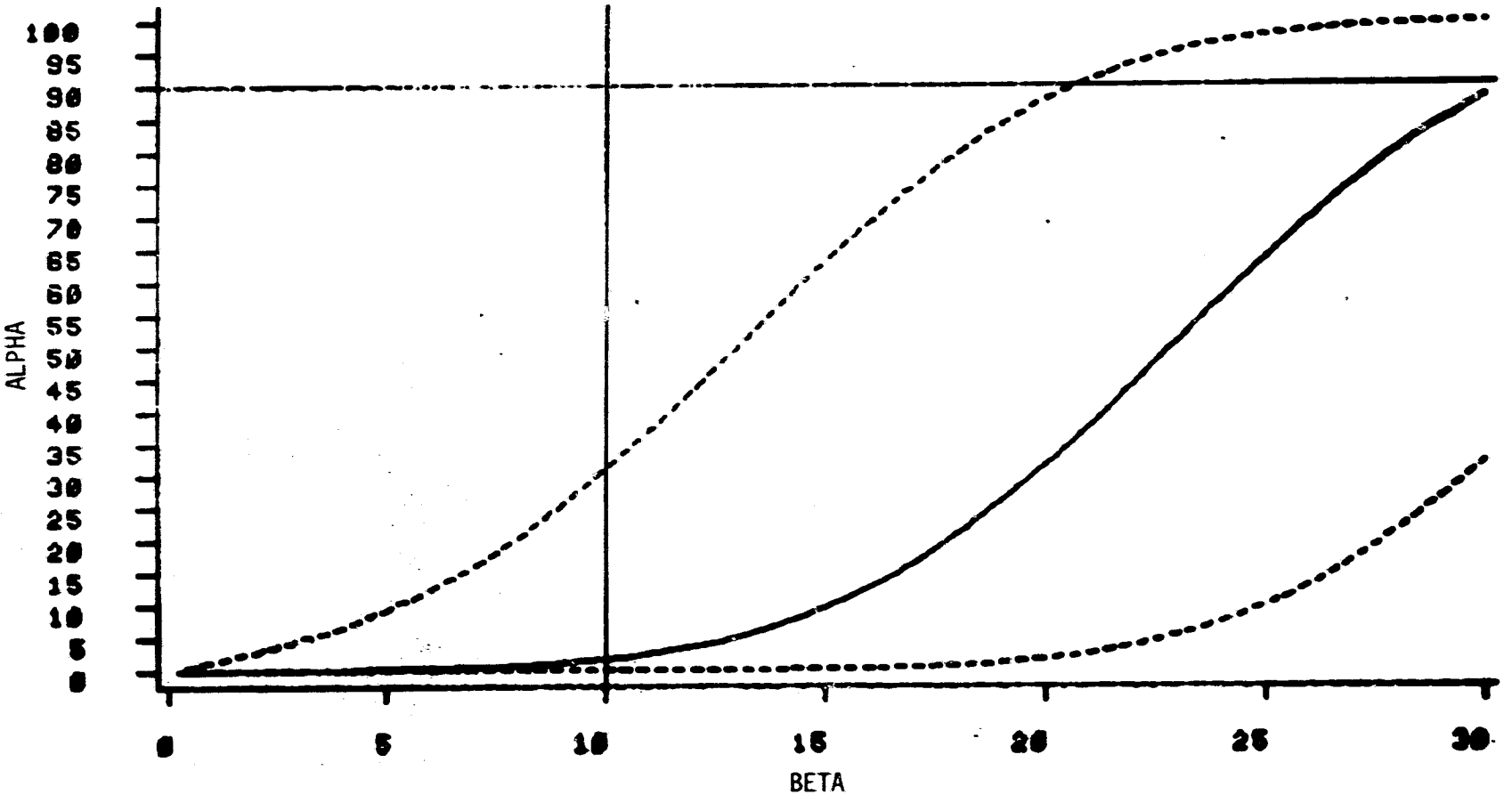


A BETA OF 1% CORRESPONDS TO AN ABSOLUTE ERROR BOUND OF 275,754 ACRES.

9/28/81

SSG4/SFG1 PERFORMANCE ENVELOPE FOR AREA

(AGGREGATION OF PROPORTION ESTIMATES FOR 1976 GROUND-TRUTH SEGMENTS IN MINNESOTA, MONTANA, NORTH DAKOTA, AND SOUTH DAKOTA)

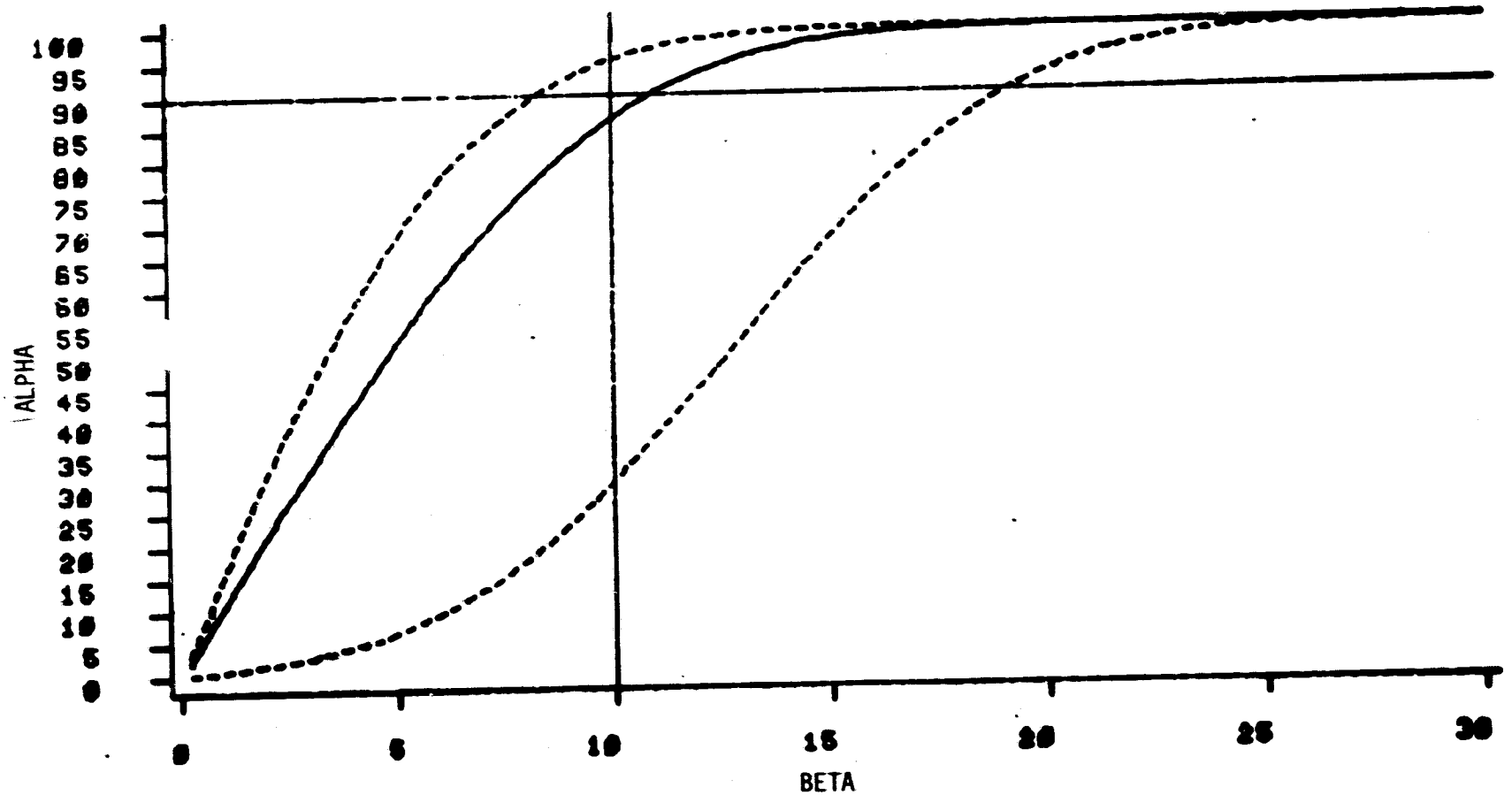


A BETA OF 1% CORRESPONDS TO AN ABOSLUTE ERROR BOUND OF 275,754 ACRES.

9/28/81

GT/SFG1 PERFORMANCE ENVELOPE FOR AREA

(AGGREGATION OF 1977 GROUND-TRUTH PROPORTIONS FOR MINNESOTA, MONTANA, NORTH DAKOTA, AND SOUTH DAKOTA)

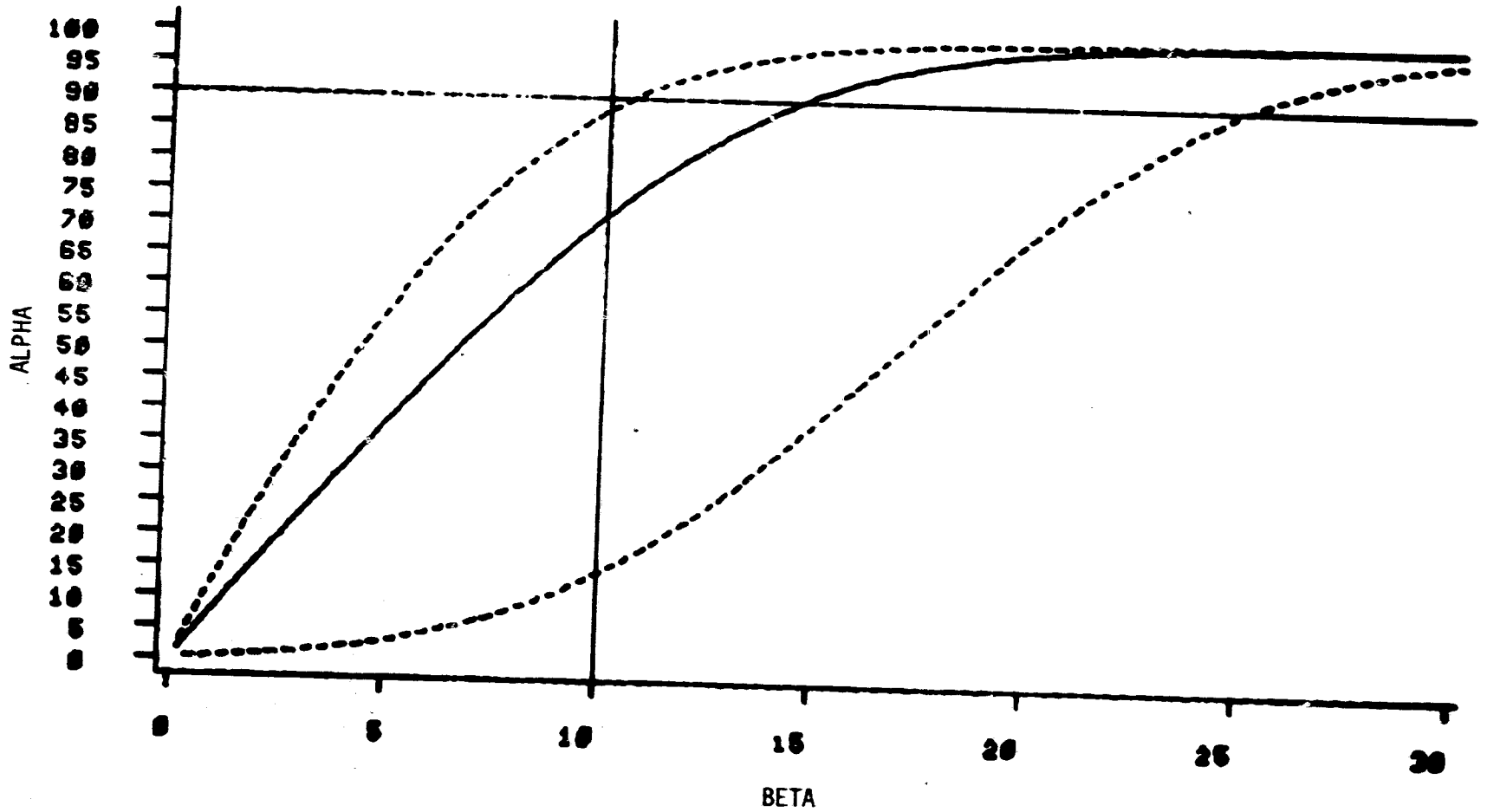


A BETA OF 1% CORRESPONDS TO AN ABSOLUTE ERROR BOUND OF 275,794 ACRES.

9/28/81

SSG3B/SFG1 PERFORMANCE ENVELOPE FOR AREA

(AGGREGATION OF PROPORTION ESTIMATES FOR 1977 GROUND-TRUTH SEGMENTS IN MINNESOTA, MONTANA, NORTH DAKOTA, AND SOUTH DAKOTA)



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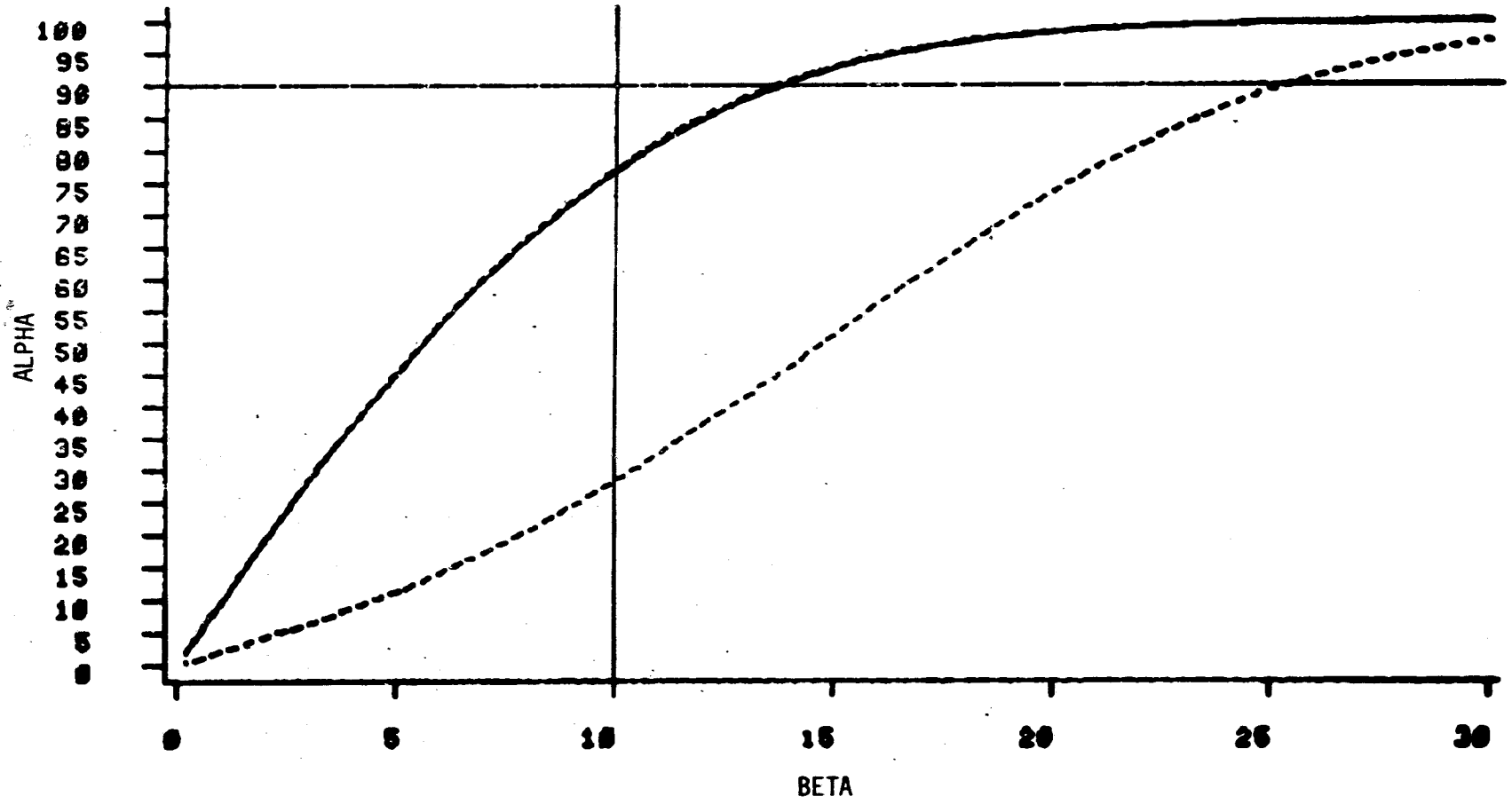
9/28/81

SSG3C/SFG1 PERFORMANCE ENVELOPE FOR AREA

(AGGREGATION OF PROPORTION ESTIMATES FOR 1977 GROUND-TRUTH SEGMENTS IN MINNESOTA, MONTANA, NORTH DAKOTA AND SOUTH DAKOTA)



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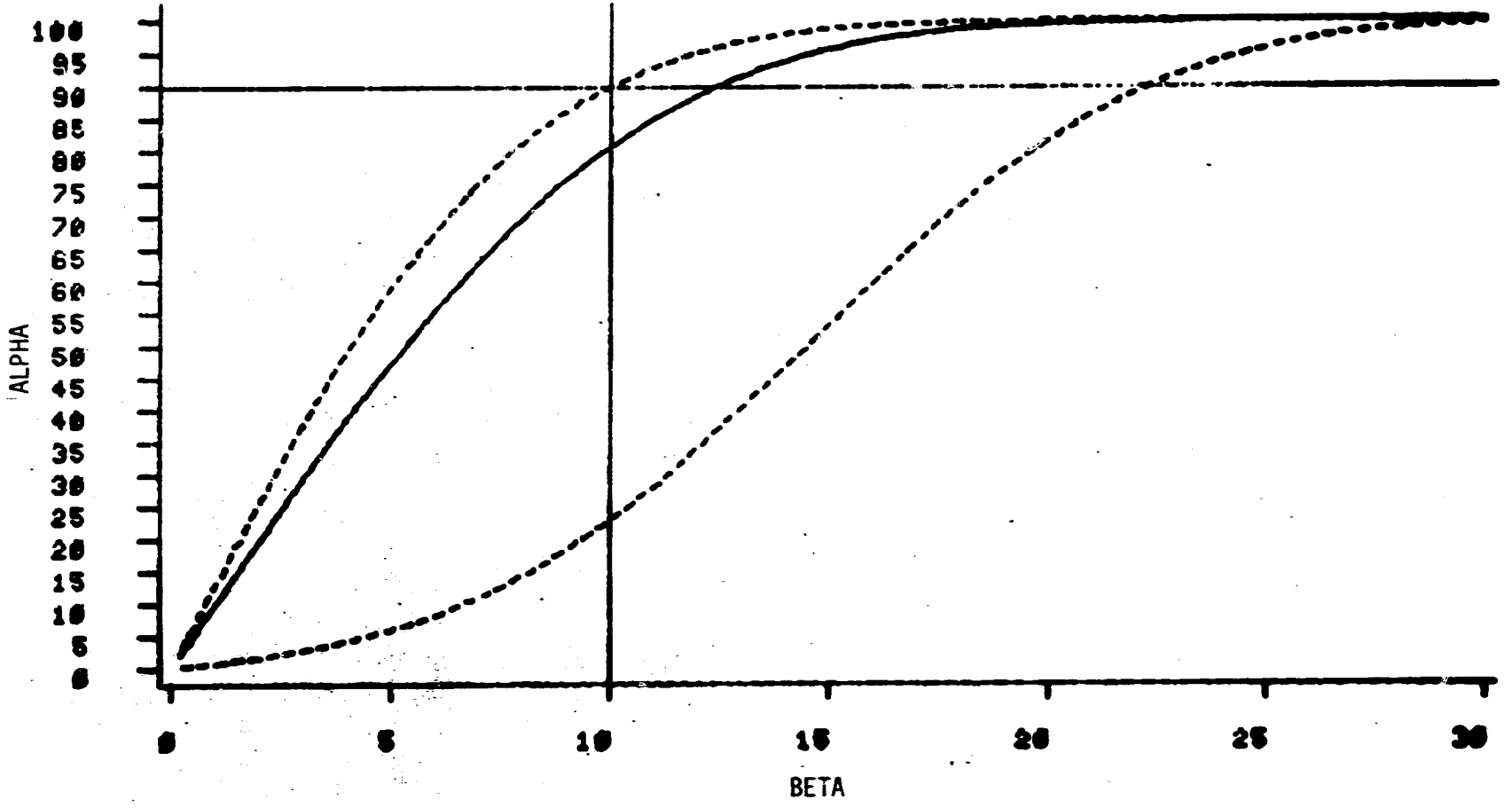
9/28/81

SSG4/SFG1 PERFORMANCE ENVELOPE FOR AREA

(AGGREGATION OF PROPORTION ESTIMATES FOR 1977 GROUND-TRUTH SEGMENTS IN MINNESOTA
MONTANA, NORTH DAKOTA, AND SOUTH DAKOTA)



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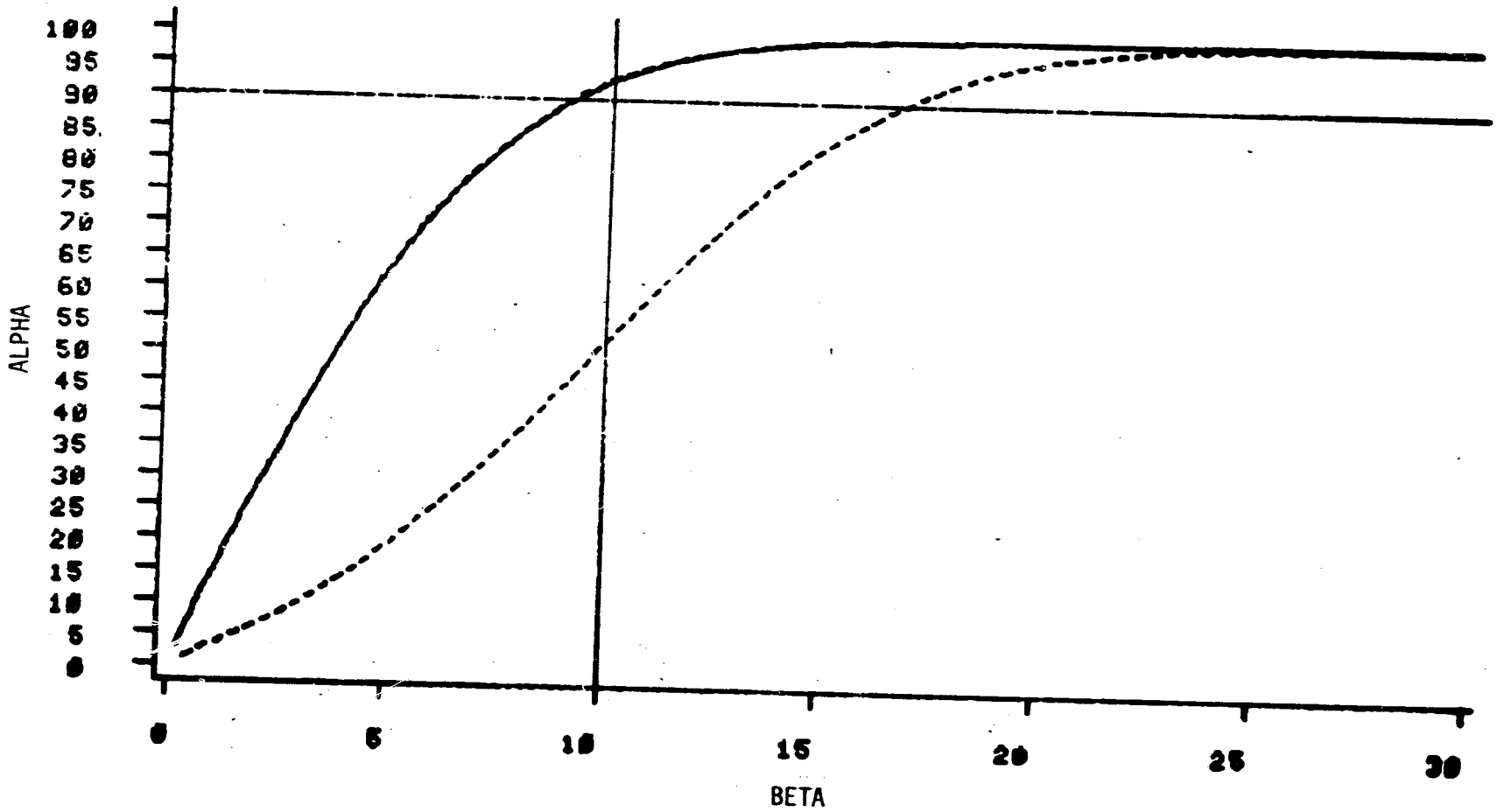
9/28/81

GT/SFG1 PERFORMANCE ENVELOPE FOR AREA

(AGGREGATION OF 1978 GROUND-TRUTH PROPORTIONS FOR MINNESOTA, MONTANA, NORTH DAKOTA, AND SOUTH DAKOTA)

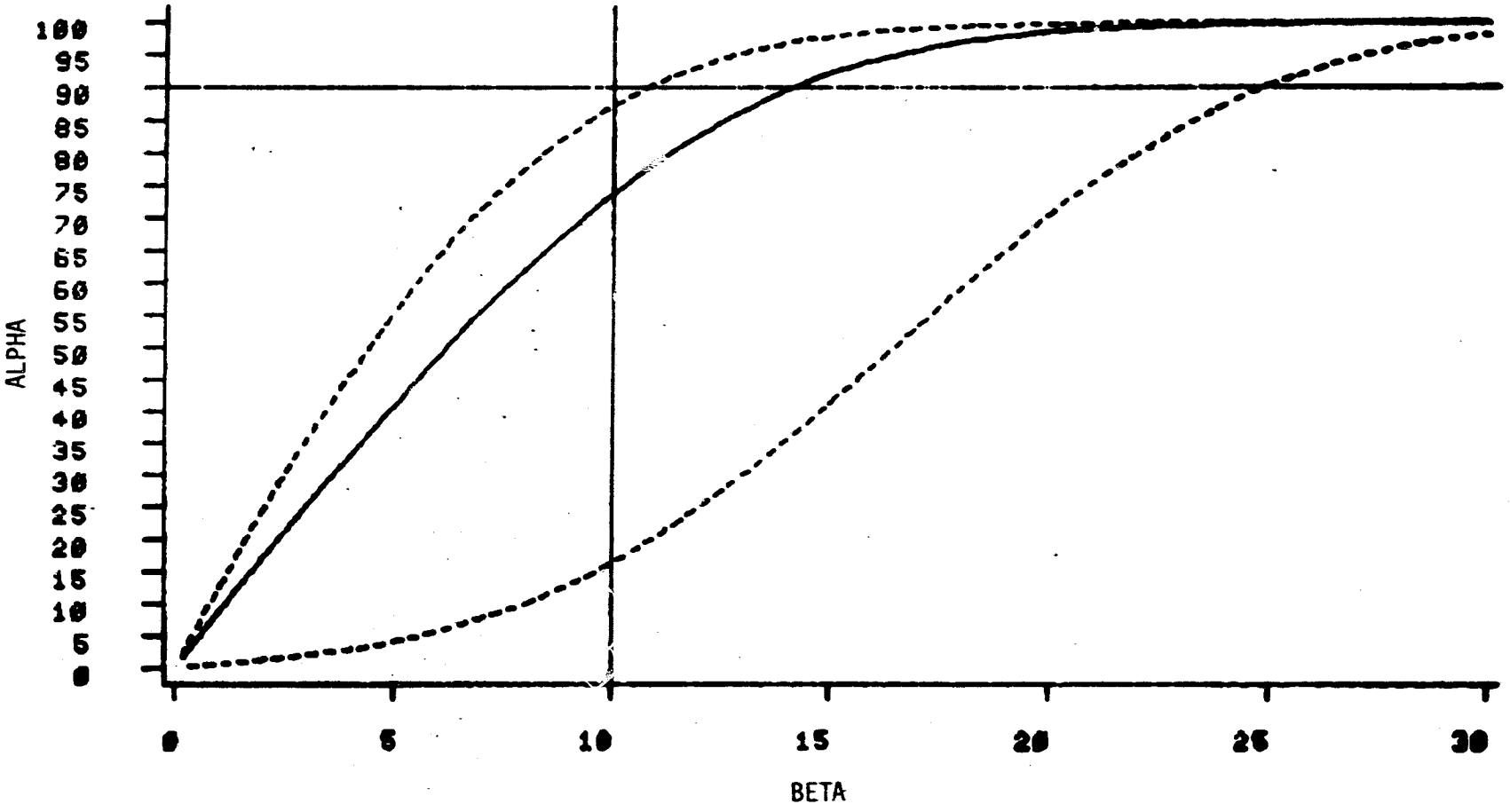


A BETA OF 1% CORRESPONDS TO AN ABSOLUTE ERROR BOUND OF 261,834 ACRES.

9/28/81

SSG3B/SFG1 PERFORMANCE ENVELOPE FOR AREA

(AGGREGATION OF PROPORTION ESTIMATES FOR 1978 GROUND-TRUTH SEGMENTS IN MINNESOTA, MONTANA, NORTH DAKOTA, AND SOUTH DAKOTA)



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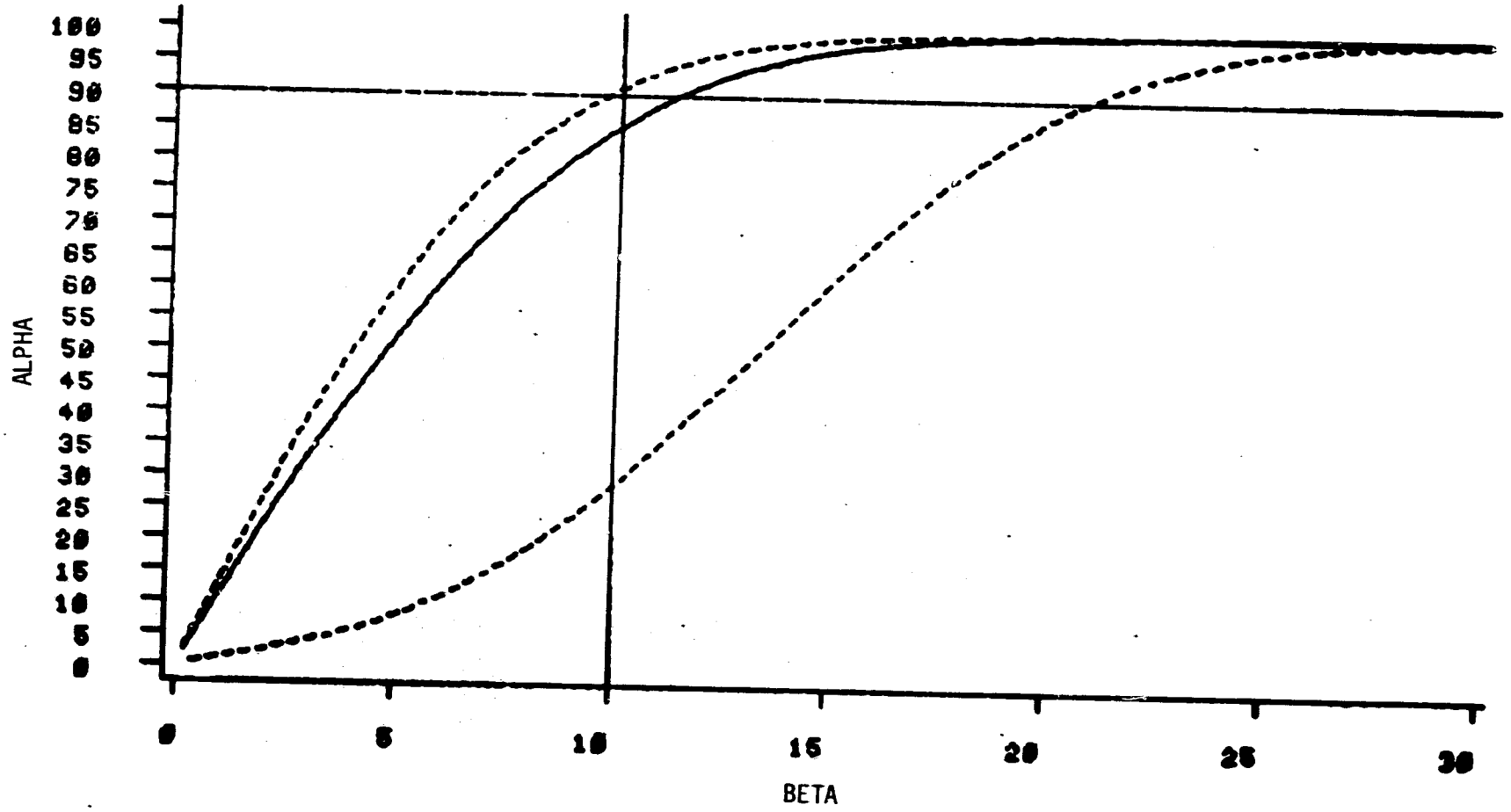

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9/28/81

SSG4/SFG1 PERFORMANCE ENVELOPE FOR AREA

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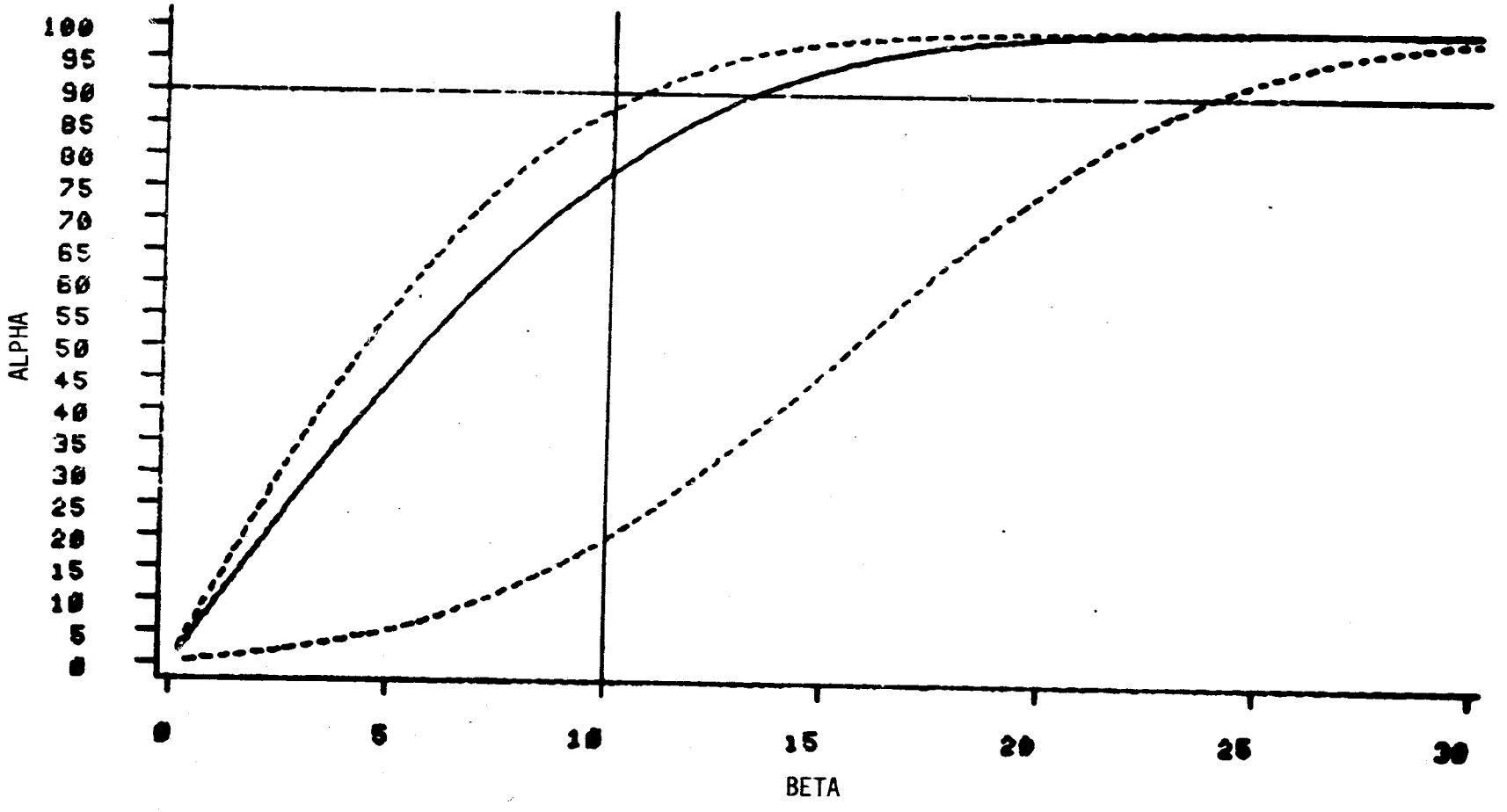

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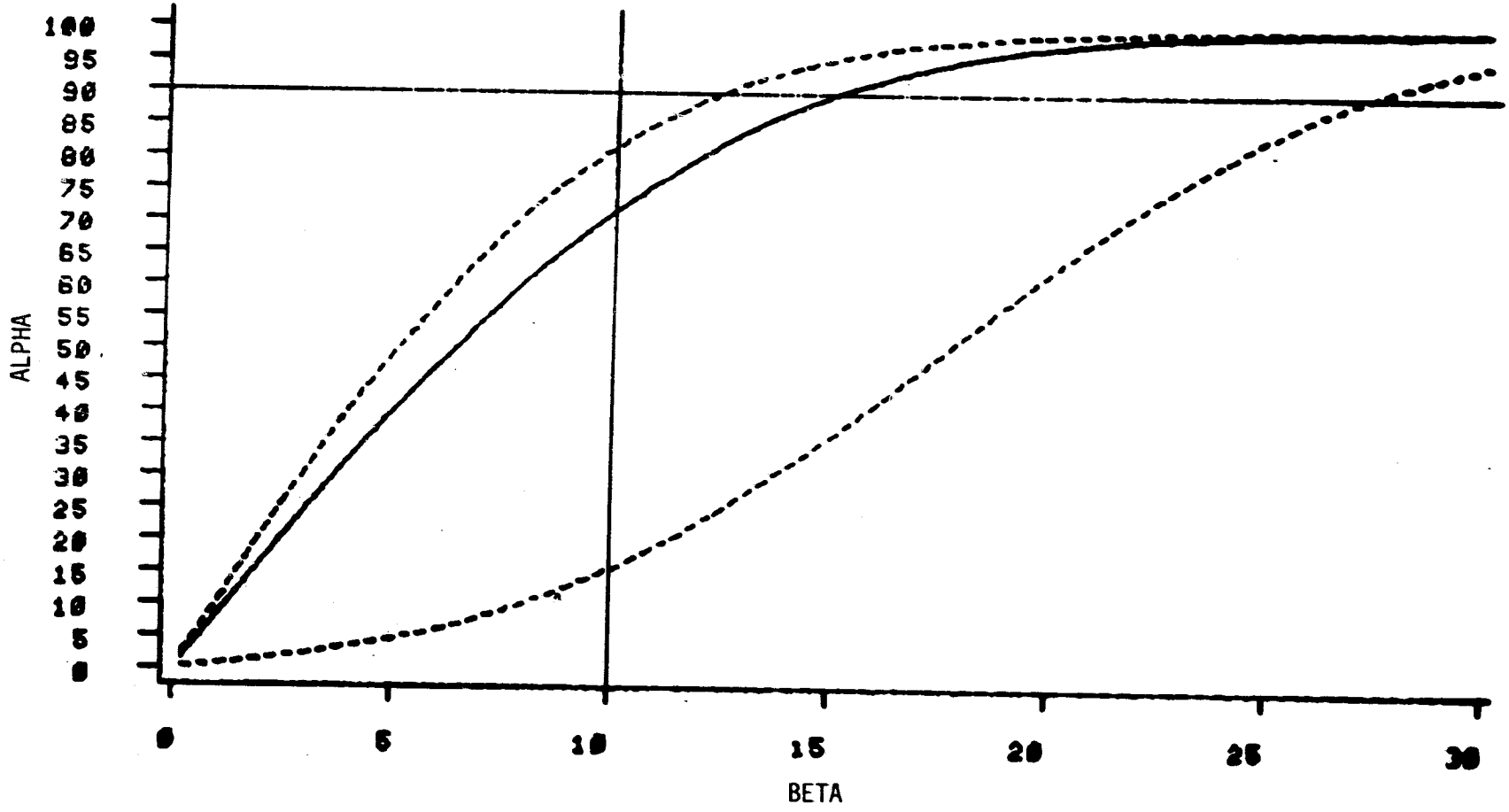
9/28/81

GT/SFG1 PERFORMANCE ENVELOPE FOR AREA

(AGGREGATION OF 1979 GROUND-TRUTH PROPORTIONS FOR MINNESOTA,
MONTANA, NORTH DAKOTA, AND SOUTH DAKOTA)

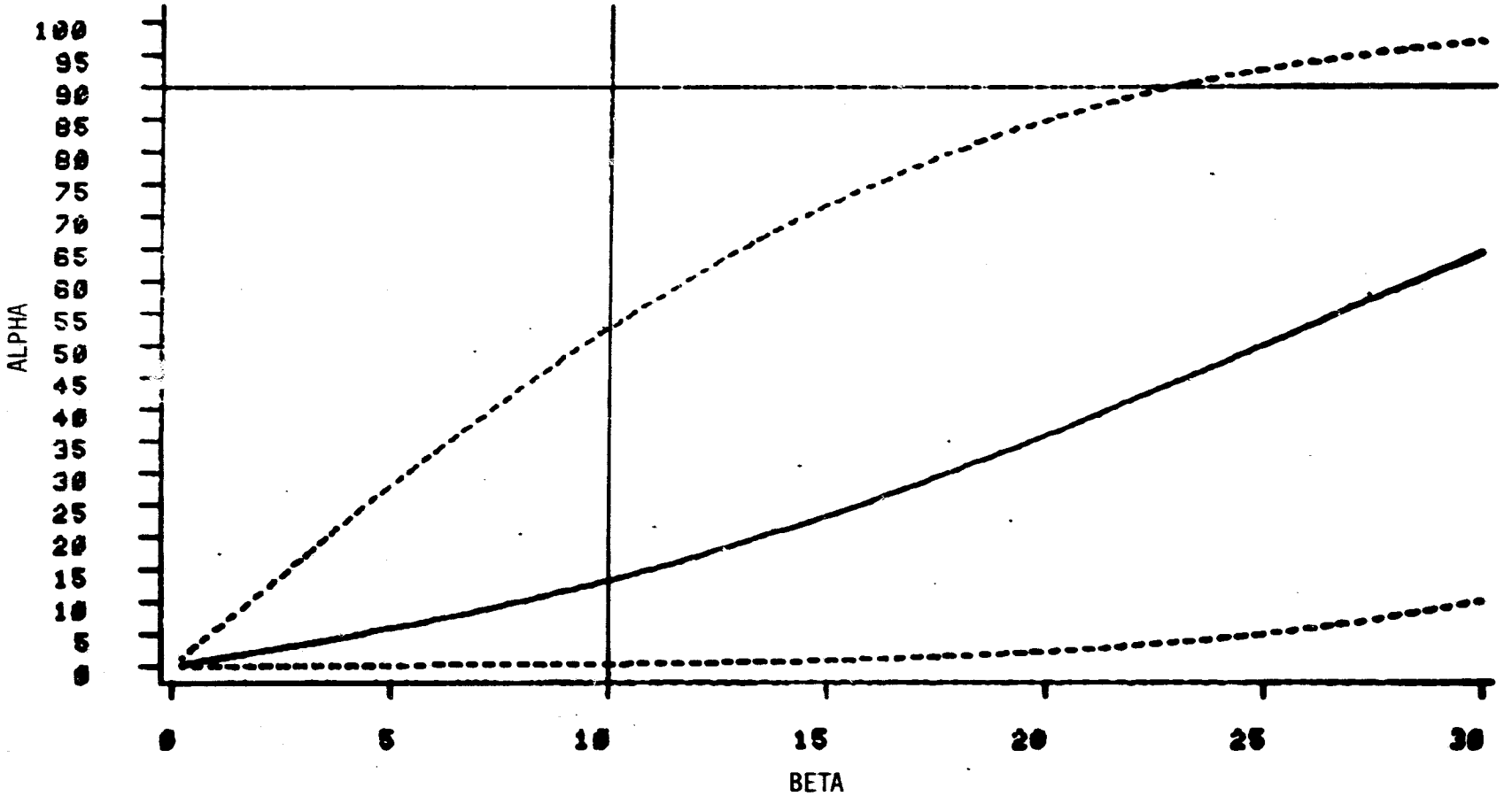


A BETA OF 1% CORRESPONDS TO AN ABSOLUTE ERROR BOUND OF 242,687 ACRES.

9/28/81

SSG3B/SFG1 PERFORMANCE ENVELOPE FOR AREA

(AGGREGATION OF PROPORTION ESTIMATES FOR 1979 GROUND-TRUTH SEGMENTS IN MINNESOTA, MONTANA, NORTH DAKOTA, AND SOUTH DAKOTA)



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SSG3C/SFG1 PERFORMANCE ENVELOPE FOR AREA

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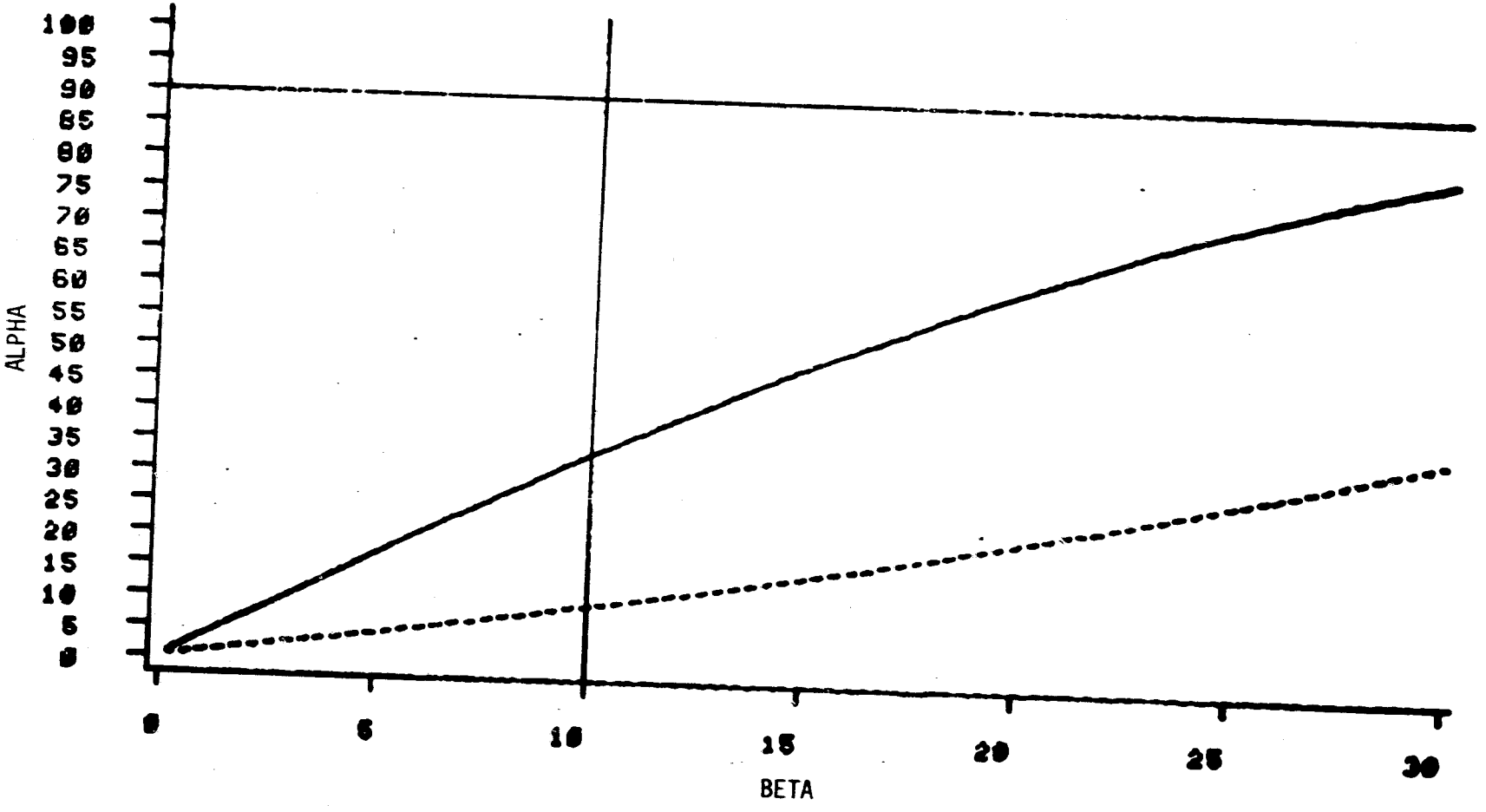

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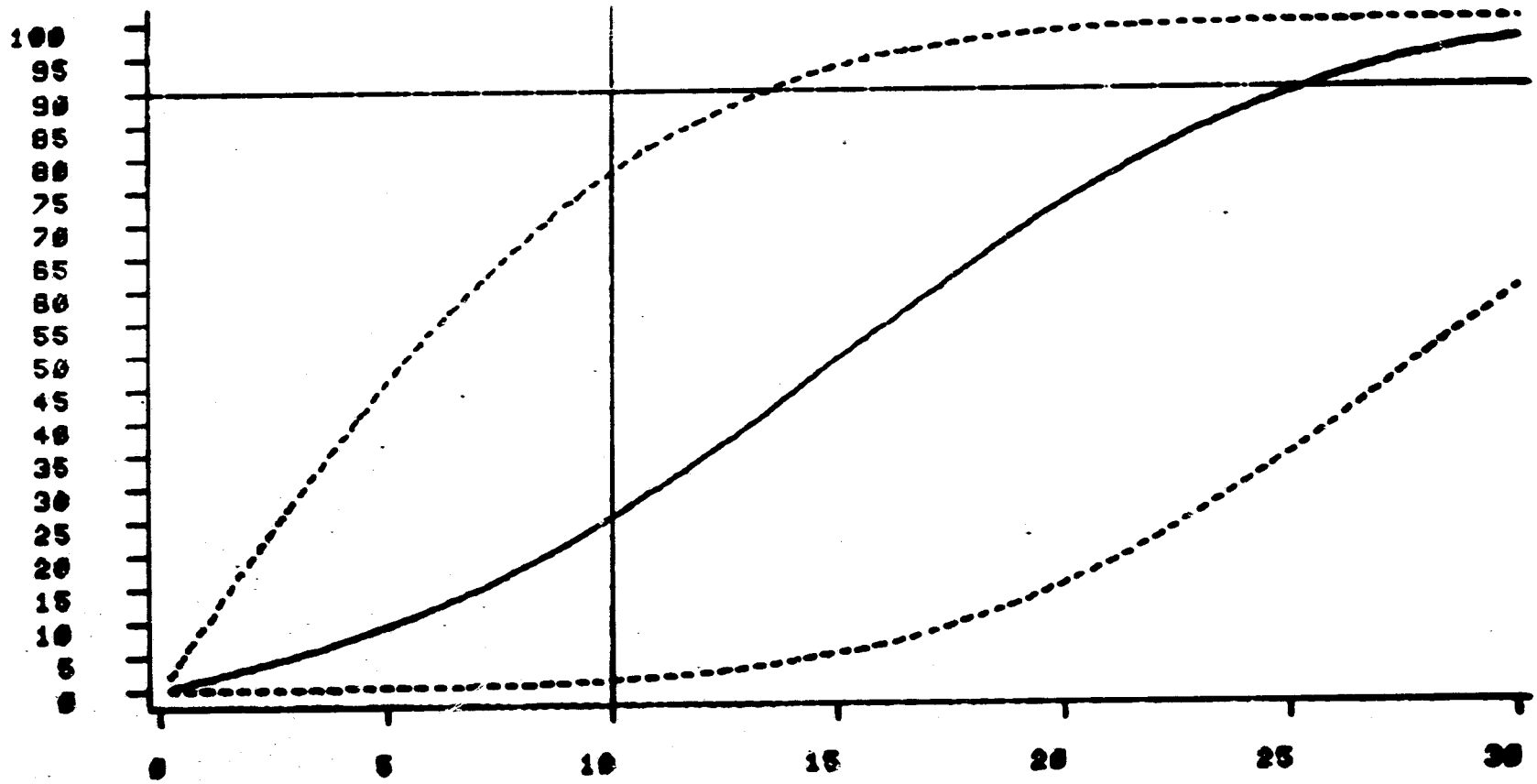
9/28/81

SSG4/SFG1 PERFORMANCE ENVELOPE FOR AREA

(AGGREGATION OF PROPORTION ESTIMATES FOR 1979 GROUND-TRUTH SEGMENTS IN MINNESOTA, MONTANA, NORTH DAKOTA, AND SOUTH DAKOTA)



A BETA OF 1% CORRESPONDS TO AN ABSOLUTE ERROR BOUND OF 242,687 ACRES.

9/28/81

SSG PILOT/4-STATE AGGREGATION RESULTS*

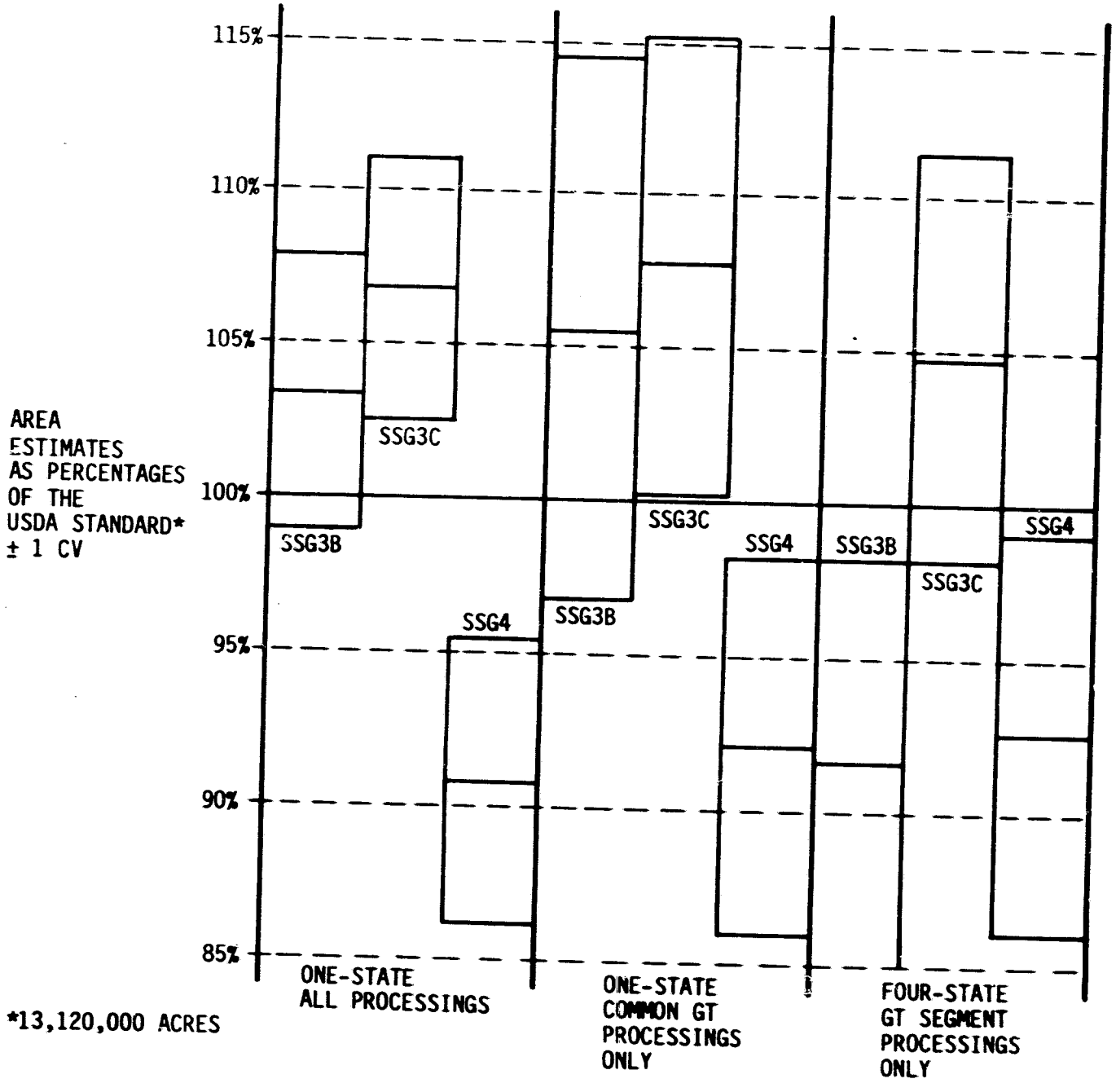
[EACH ENTRY IS EXPRESSED AS A PERCENTAGE OF THE USDA ESTIMATE OF SPRING SMALL GRAINS AREA IN THE APPROPRIATE YEAR]

YEAR / USDA AREA ESTIMATE	SEGMENT ESTIMATION PROCESSING	AREA ESTIMATE	COEFFICIENT OF VARIATION	RELATIVE ERROR	COMPONENTS OF RELATIVE ERROR			NUMBER OF SEGMENTS
					RATIOING	SAMPLING	CLASS.	
1976	GT	103.86	5.80	3.86	4.01	-0.15	0.00	32
	SSG3B	121.59	7.80	21.59	4.85	0.83	15.90	24
27,575,400 ACRES	SSG3C	116.10	8.23	16.10	3.55	0.11	12.44	17
	SSG4	77.13	6.02	-22.87	3.67	-0.94	-25.60	31
1977	GT	104.43	5.02	4.43	-3.56	7.98	0.00	40
	SSG3B	106.25	6.41	6.25	-5.22	3.70	7.77	32
27,579,400 ACRES	SSG3C	101.10	8.29	1.10	-5.51	3.26	3.35	24
	SSG4	104.54	6.07	4.54	-3.12	9.39	-1.73	31
1978	GT	99.33	5.50	-0.67	-1.22	0.56	0.00	46
	SSG3B	94.34	6.56	-5.66	-0.86	-1.23	-3.56	38
26,183,400 ACRES	SSG3C	96.41	5.90	-3.59	-1.23	-1.03	-1.32	36
	SSG4	95.17	6.51	-4.83	-1.50	2.63	-5.95	42
1979	GT	105.21	7.55	5.21	-2.75	7.95	0.00	31
	SSG3B	124.98	13.76	24.98	-2.52	2.69	24.81	17
24,268,700 ACRES	SSG3C	99.74	23.18	-0.26	-0.75	-11.11	11.60	11
	SSG4	115.19	7.86	15.19	-2.08	14.62	2.65	27

*THE AGGREGATION PROCEDURE USED WAS SFG1. THESE ARE PRELIMINARY RESULTS.

9/28/81

COMPARISON OF NORTH DAKOTA 1978 AREA ESTIMATION RESULTS FOR THREE AGGREGATIONS



*13,120,000 ACRES

SSG PILOT FOUR-STATE AGGREGATION RESULTS (CONTINUED)

[ALL AREAS AND STANDARD DEVIATIONS ARE EXPRESSED IN ACRES X 1000.
THESE ARE PRELIMINARY RESULTS.]

KEY:

NUMBER OF SEGMENTS USED	AREA ESTIMATE
	STANDARD DEVIATION OF AREA ESTIMATE

		MINNESOTA	MONTANA	NORTH DAKOTA	SOUTH DAKOTA	4-STATE
1976	USDA	5984.40	3,088.00	14,840.00	3,663.00	27,575.40
	GT	3 / 5,466.22 / 347.44	11 / 3,015.70 / 222.34	14 / 14,843.79 / 831.33	4 / 5,223.96 / 345.20	32 / 28,639.67 / 1,598.74
	SSG3B	3 / 6,400.57 / 443.58	6 / 3,684.59 / 284.18	11 / 17,326.67 / 1,117.20	4 / 6,116.67 / 438.37	24 / 33,528.50 / 2,151.93
	SSG3C	0 / 6,068.61 / 463.99	2 / 3,520.68 / 282.92	12 / 16,585.25 / 1,168.19	3 / 5,841.01 / 446.15	17 / 32,015.55 / ,2,268.88
	SSG4	2 / 5,270.89 / 527.44	11 / 1,914.51 / 259.66	14 / 10,022.13 / 921.45	4 / 4,061.47 / 347.21	31 / 21,268.98 / 1,661.20
1977	USDA	5,942.90	3,234.00	13,180.00	5,222.50	27,579.40
	GT	8 / 6,308.32 / 445.15	9 / 3,259.77 / 335.21	12 / 14,963.44 / 887.95	11 / 4,269.01 / 364.12	40 / 28,800.52 / 1,384.27
	SSG3B	5 / 6,152.66 / 453.12	8 / 3,263.52 / 315.71	11 / 15,820.64 / 977.04	8 / 4,067.01 / 353.52	32 / 29,303.79 / 1,767.50
	SSG3C	4 / 5,920.07 / 551.94	5 / 3,150.28 / 362.41	9 / 14,971.54 / 1,250.56	6 / 3,840.28 / 402.90	24 / 27,882.14 / 2,286.95
	SSG4	7 / 6,012.96 / 413.78	5 / 3,120.67 / 306.60	8 / 15,347.11 / 950.04	11 / 4,350.63 / 331.33	31 / 28,831.37 / 1,673.90

SSG PILOT FOUR-STATE AGGREGATION RESULTS (CONCLUDED)

[ALL AREAS AND STANDARD DEVIATIONS ARE EXPRESSED IN ACRES X 1000.
THESE ARE PRELIMINARY RESULTS.]

1978	USDA	5,049.30		3,048.90		13,120.00		4,965.20	26,183.40
	GT	12	5,185.73 / 407.10	6	3,102.56 / 341.58	21	12,796.52 / 721.32	7	4,923.63 / 453.14	46	26,008.42 / 1,440.21
	SSG3B	12	4,989.26 / 461.17	5	3,160.63 / 364.78	17	12,028.44 / 854.86	4	4,522.88 / 502.71	38	24,701.20 / 1,718.13
	SSG3C	12	3,747.90 / 599.42	4	3,378.72 / 321.66	16	13,759.46 / 869.51	4	4,358.13 / 442.36	36	25,244.19 / 1,545.57
	SSG4	11	5,009.62 / 459.65	6	2,903.41 / 361.93	18	12,149.27 / 848.34	7	4,856.31 / 488.04	42	24,918.60 / 1,703.66
1979	USDA	4298.50		3,488.90		11,970.00		4,511.30	24,268.70
	GT	5	4,821.16 / 456.16	1	2,968.88 / 356.33	22	12,899.12 / 899.55	3	4,842.99 / 496.05	31	25,532.14 / 1,832.58
	SSG3B	4	5,753.23 / 693.43	0	3,531.64 / 470.99	12	15,302.78 / 1,668.99	1	5,742.84 / 717.54	17	30,330.46 / 3,339.55
	SSG3C	1	4,642.50 / 1,113.58	0	2,818.36 / 697.75	8	12,164.98 / 2,816.82	2	4,578.61 / 1,107.47	11	24,204.45 / 5,625.43
	SSG4	2	6,167.01 / 737.39	1	3,036.64 / 419.08	21	13,702.84 / 925.79	3	5,048.62 / 746.44	27	27,955.09 / 1,907.45

OBSERVATIONS ON FOUR-STATE AGGREGATION RESULTS

- THE PERFORMANCES OF THE THREE LARGE AREA ESTIMATION SYSTEMS ARE:
  - + EQUALLY GOOD IN 1977 AND 1978
  - + EQUALLY BAD IN 1976 (LARGE BIAS)
  - + POOR IN 1979 (LARGE C.V. AND/OR LARGE BIAS)

- THE GT AGGREGATION RESULTS:
  - + CORRESPOND CLOSELY TO THE USDA ESTIMATES FOR ALL YEARS
  - + SHOULD SERVE AS THE BASIS FOR COMPARISON OF THE PERFORMANCES OF THE THREE SEGMENT ANALYSIS PROCEDURES

- IN EVERY YEAR, THE LOWEST CV IS ATTAINED BY THE PROCEDURE WITH THE HIGHEST PROCESSING RATE

- IN EVERY YEAR, THE MAJOR DIFFERENCES IN THE RELATIVE ERRORS OF THE THREE SYSTEMS CAN BE TRACED TO DIFFERENCES IN CLASSIFICATION ACCURACY (AND PROCESSING RATE) FOR THE SEGMENT ANALYSIS PROCEDURES

PRELIMINARY CONCLUSIONS:

- THE BASELINE AGGREGATION TECHNOLOGY CAN PRODUCE ACCURATE LARGE AREA ESTIMATES USING SURPRISINGLY FEW SEGMENT PROPORTIONS, PROVIDED THOSE PROPORTIONS ARE THEMSELVES ACCURATE

- THESE RESULTS SHOW AREAS WHERE MORE DEVELOPMENT WORK IS NEEDED:
  - + PROPORTION ESTIMATION - TO REMEDY DEFICIENCIES IN RATE OF PROCESSABILITY IN 1979 (SSG3B, SSG3C) AND CLASSIFICATION ACCURACY IN BOTH 1976 AND 1979 (SSG3B, SSG3C, SSG4)
  - + AGGREGATION TECHNOLOGY - TO ADJUST FOR DEFICIENCIES IN RATE OF PROCESSABILITY AND CLASSIFICATION ACCURACY OF THE PROPORTION ESTIMATION PROCEDURE

- RESULTS ILLUSTRATE THE LIMITATIONS OF USING A ONE-YEAR, ONE-STATE AGGREGATION BASED ON A SMALL NUMBER OF SEGMENTS TO IDENTIFY SYSTEM CHARACTERISTICS

- THE ACCURACIES OF THESE LARGE AREA ESTIMATES ALONE PROVIDE NO BASIS FOR CHOOSING A 'BEST' PROPORTION ESTIMATION PROCEDURE *

*A STUDY COMPARING SFG-1 AND OTHER ALTERNATIVE AGGREGATION TECHNOLOGIES IS PLANNED FOR FISCAL YEAR '81-82.

5.0 EXPERIMENT SUMMARY

R. BIZZELL
9/28/81

MAJOR ACCOMPLISHMENTS

U.S. SPRING SMALL GRAINS PILOT:

- DEVELOPMENT/EVALUATION OF IMPROVED AREA ESTIMATION SUBSYSTEM
  - -- AUTOMATION
  - -- EFFICIENCY
  - -- OBJECTIVITY
  - -- ACCURACY
- DEVELOPMENT/EVALUATION OF AUTOMATED, EFFICIENT PROPORTION ESTIMATION COMPONENT
  - -- THREE AUTOMATED PROCEDURES (SSG3B COMPLETED EARLY)
  - -- EFFICIENCY
  - -- OBJECTIVITY
  - -- CONSISTENCY
  - -- ACCURACY
  - -- INCORPORATION OF MET DATA -- OBJECTIVE USE
- DEVELOPMENT/EVALUATION OF IMPROVED AREA AGGREGATION COMPONENT
  - -- OBJECTIVITY AND EFFICIENCY
  - -- STRATA GROUPING STRATEGY
  - -- FOUR-STATE/FOUR-YEAR AGGREGATION
- PROCEDURES SUBCOMPONENT DEVELOPMENT/EVALUATION
  - -- MODULAR DEVELOPMENTS
  - -- UNDERSTANDING FOR IMPROVEMENTS
  - -- QUANTIFY IMPROVEMENTS (EFFICIENCY, ACCURACY, ETC.)
- DATA SYSTEM DEVELOPED/IMPLEMENTED IN-HOUSE
  - -- MODULAR SUBSYSTEMS (INCLUDING DATA BASES), MULTI-PURPOSE (FCPF EXPERIMENTS, TECHNOLOGY DEVELOPMENT)
  - -- CONFIGURED SOFTWARE/PROCEDURES (PROPORTION ESTIMATION AND AREA AGGREGATION)
  - -- CONFIGURED RESULTS DATA BASES (EVALUATIONS)
- DATA REQUIREMENTS
  - -- STANDARD DATA SETS

MAJOR ACCOMPLISHMENTS (CONCLUDED)

U.S. SPRING SMALL GRAINS PILOT (CONTINUED):

- PROCESSED/ANALYZED LARGE DATA SET
  - -- IMPLEMENTATION OF MULTIPLE PROCEDURES OVER MULTI-YEARS
  - -- SCHEDULES MET
- DEVELOPMENT OF EXPERIMENT DATA SET
  - -- PREPROCESSING DATA BASES (VERIFY INTEGRITY)
  - -- MULTI-PURPOSE (FUTURE EXPERIMENTS/DEVELOPMENTS)
- EXPERIMENT DESIGN/EVALUATION PROCESS
  - -- COMPLEX DESIGN SUCCESSFULLY IMPLEMENTED/COMPLETED
  - -- SUBCOMPONENT EVALUATIONS
  - -- PROCEDURE SENSITIVITY STUDIES -- LARGE NUMBER CONDUCTED
  - -- AGGREGATION SUBCOMPONENT STUDIES
  - -- COMPLETION OF UNSCHEDULED STUDIES (ERROR CHARACTERIZATIONS AND FOUR-STATE/FOUR-YEAR AGGREGATION)
- TECHNOLOGY DEVELOPMENT SUPPORT
  - -- ERROR MODEL
    - + POSITIVE INDICATIONS OF RELATING MEANINGFUL PARAMETERS TO ESTIMATION ERROR (IN FOREIGN AREAS)
  - -- PROCEDURE DEVELOPMENTS
  - -- SIMULATION STUDY SUPPORT

FOREIGN SMALL GRAINS UNDERSTANDING:

- USSR
  - -- ADAPTATION STUDIES - INDICATIONS THAT LABELING/PROPORTION PROCEDURE PROVIDES VIABLE BASIS FOR USSR SPRING SMALL GRAINS
- AUSTRALIA
  - -- GROUND DATA COLLECTION (1981 CROP YEAR) TO SUPPORT DEVELOPMENTS/EXPERIMENTS
    - + REQUIREMENTS
  - -- COLLECTION COORDINATION
- FOREIGN SIMILARITY AND INDICATOR REGION SELECTIONS
  - -- USSR
  - -- AUSTRALIA

BONUSES

- COMPLETION OF IMPLEMENTATION, PROCESSING AND PRELIMINARY EVALUATION OF SSG3B PROCEDURE DURING FY81
- FOUR-STATE/FOUR-YEAR AREA AGGREGATION AND EVALUATION
- ERROR CHARACTERIZATION ON PROPORTION ESTIMATION SUBCOMPONENTS
- DATA SYSTEM DEVELOPED/IMPLEMENTED IN-HOUSE
- DATA BASES, AREA ESTIMATION SOFTWARE CONFIGURED
- IMPLEMENTATION OF A MORE RIGOROUS DESIGN PROCESS

SMALL GRAINS SUMMARY/OUTLOOK

- o AUTOMATION OF THE SPRING SMALL GRAINS PROPORTION ESTIMATION TECHNOLOGY WAS HIGHLY SUCCESSFUL.
  - + HIGHLY EFFICIENT
  - + GOOD PERFORMANCE
- o EFFICIENCIES WITH AUTOMATED TECHNOLOGIES ALLOW FOR TESTING AND DEVELOPMENT THAT WERE PREVIOUSLY COST PROHIBITIVE.
  - + QUICKER AND MORE THOROUGH DIAGNOSTIC ASSESSMENT OF MODIFICATIONS TO THE PROPORTION ESTIMATION PROCEDURES
  - + SUPPORT TO SAMPLING DEVELOPMENT
  - + LARGE SCALE AGGREGATION SUBCOMPONENT AND COMPONENT ASSESSMENT

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SMALL GRAINS SUMMARY/OUTLOOK (CONTINUED)

- o AUTOMATIC PROPORTION ESTIMATION PROCEDURES IMPLICATIONS
  - + CLASSICAL ADVANCED PATTERN RECOGNITION TECHNOLOGY REQUIREMENTS REDUCED
    - + ONLY FOR PER SEGMENT PROCEDURES
    - + MULTISEGMENT OR OTHER PRODUCTION ESTIMATION TECHNOLOGY APPROACHES MAY BE DIFFERENT
  - + IMPLEMENTATIONS HAVE DELIBERATELY AVOIDED DIRECT SENSITIVITY TO CROP STAGES-HISTORICALLY DIFFICULT TO PROVIDE.
  - + NEED TO BETTER UNDERSTAND INTERACTIONS BETWEEN LABELING LOGIC MODELING, ACQUISITION SELECTION SENSITIVITIES AND PROPORTION ESTIMATION ERROR.
  - + PROCESSABILITY RATES NEED TO BE EXAMINED FOR POSSIBLE IMPROVEMENT.
    - + REDUCE AGGREGATION VARIANCE
    - + ANTICIPATED ACQUISITION REDUCTION IN FOREIGN REGIONS

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SMALL GRAINS SUMMARY/OUTLOOK (CONTINUED)

- o THE ADVANCED LARGE AREA ESTIMATION TECHNOLOGY SUBCOMPONENT EVALUATION WAS SUCCESSFUL
  - + OBJECTIVE GROUPING SUBCOMPONENT EVALUATION SUCCESSFUL
  - + END-TO-END SINGLE YEAR AGGREGATION MET EXPECTATIONS
- o NEED TO CONTINUE PLANNED EVALUATIONS OF DESIGNED AGGREGATION EVALUATIONS
  - + MULTIYEAR AGGREGATION TO STRATUM LEVELS
  - + ESTIMATES OF SUBCOMPONENT CONTRIBUTIONS TO THE OVERALL AGGREGATION ERROR.

SMALL GRAINS SUMMARY/OUTLOOK (CONCLUDED)

- o Because of the success of the automated technologies may want to reassess emphasis for FY82.
  - + Approach for adaptation to foreign regions may utilize more aspects of the automated procedures rather than the more exhaustive analyst oriented procedures.
  - + Continuation of the planned semi-automated proportion estimation procedure, SSG2 will be re-examined.
- o The status of the FCPF technology is A OK.
  - + Ahead of schedule
  - + Performance as good or better than anticipated
  - + Payoffs from advances in more efficient proportion estimation procedures, more objective large area estimation procedures and implementation of integrated experimental system have been substantial.